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A CONCEPTUAL APPROACH FOR ANALYSIS AND EVALUATION
OF BRANCH LINE ABANDONMENT

BY

DALE BERTSCH

A thesis submitted
in partial fulfillment of the requirements for the
degree Master of Science, Major in
Economics, South Dakota
State University

1977

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A CONCEPTUAL APPROACH FOR ANALYSIS AND EVALUATION
OF BRANCH LINE ABANDONMENT

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~~Th~~esis Advisor // ~~D~~ate

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CHAPTER I

INTRODUCTION

The demand for rail freight service in South Dakota originates from three sources. The first source is those shippers who desire to transport their products out of South Dakota to processors, manufacturers, exporters, and other users. The second source is those shippers who transport supplies, materials, and other products into South Dakota. The third source is the demand for services to connect with rail trackage in other states so that their products can be transported through South Dakota.

There are five railroad companies operating in South Dakota. They are: Chicago, Milwaukee, St. Paul, and Pacific Railroad Company (MILW); Burlington Northern Incorporated (BN); Chicago and Northwestern Transportation Company and Transportation Subsidiaries (CNW); Soo Line Railroad Company (SOO); and Illinois Central Gulf Railroad Company (ICG). Those railroad companies supply freight service in South Dakota to fulfill the above demands and to earn profits from providing freight service. In recent years, however, some railroads have faced a number of problems which have resulted in declining revenues and income, reduced shares of the freight market, and deferred capital maintenance. Table 1 shows deferred maintenance of four railroad companies doing business in South Dakota. Further, as illustrated in Table 2, operating expenses have increased steadily from 1972 to 1974. To deal with these problems railroad companies

Table 1: Deferred Maintenance of Four Railroad Companies in South Dakota as of March 31, 1975, (\$1,000 units)*

Railroad	Deferred Maint. Railbed	Deferred Maint. Equipment	Switch Bridge Rail Cross Ties Needed	Rail Needed	Delayed Capital Improvements
BN	76,885	15,265	7,185	---	338,036
CNW	675,257	16,291	53,213	1,345	266,872
MILW	60,768	16,592	9,501	77	68,700
ICG	89,973	7,865	7,161	178	186,005

*The figures represent deferred maintenance for the entire system.

SOURCE: United States Department of Transportation, The Replacement of Alton Locks and Dam 26; An Advisory Report to the Senate Commerce Committee, September, 1975, p. 51. The original source of the data was, Interstate Commerce Commission Schedule C, Deferred Maintenance, Plant and Equipment for Quarter Ending March 31, 1975.

have developed and adopted new technology in rail car size, serviceability, car scheduling, car utilization, and unit and multicar train shipments. Even with these and other efforts, however, many railroads have continued to record either losses or low profits as illustrated in Table 2.

As an additional effort to improve efficiency many railroad companies have filed petitions with the Interstate Commerce Commission (ICC) for abandoning trackage which does not provide enough revenue to cover costs. These efforts to abandon certain segments of rail trackage have become a focal point for controversy between the communities and shippers being served by those lines and the rail companies seeking to discontinue service.

Table 2: Revenue and Expenses for Five Railroad Companies Operating in South Dakota for 1972, 1973 and 1974 (1,000 dollar units)

	A	B	C	D	E	F	G	H
	RR Operating Revenues	Operating Expenses	Net Operating Revenues	OR Related to Freight Service	OE Related to Freight Service	Net Revenue Related to Freight Service	Net Income or Loss	Operating Ratio (B/A)
Milw 74	394,676	313,578	81,098	384,053	302,833	81,220	868	79.5
Milw 73	355,390	285,527	47,421	348,029	269,309	78,720	3,405	80.3
Milw 72	312,831	265,410	47,421	305,921	251,462	54,459	-8,643	84.8
CNW 74	484,957	394,928	90,029	457,710	323,667	133,503	-5,288	81.4
CNW 73	416,681	325,435	91,246	392,317	261,490	130,827	15,260	78.1
CNW 72	216,431	167,337	49,094	202,830	131,819	71,011	11,600	77.3
BN 74	1,290,829	1,026,656	264,173	1,276,388	798,983	477,405	77,549	79.5
BN	1,093,603	903,803	189,800	1,084,569	684,395	400,174	38,656	82.6
BN 72	1,000,516	827,620	172,895	991,696	809,275	182,421	40,961	82.7
SOO 74	179,792	124,927	54,845	NA	NA	NA	17,039	69.4
SOO 73	168,324	114,999	53,325	168,324	114,999	53,325	17,620	68.3
SOO 72	140,651	102,409	38,242	NA	NA	NA	10,264	72.8
ICG 74	577,843	449,220	128,623	560,652	324,789	235,854	32,977	77.7
ICG 73	525,993	395,442	130,551	514,103	284,483	229,620	45,132	75.2
ICG 72	408,962	324,203	84,759	397,848	234,903	162,945	37,624	79.1

SOURCE: Data in columns A, B, C, D, E, F, and H were found in the annual reports to the South Dakota Public Utilities Commission by the five railroad companies doing business in South Dakota. Data in columns A, B, C, and G were found in Carrier Reports.

History of Rail Abandonment

Nationally, between 1960 and 1973 there were 1,937 applications filed with the ICC to abandon a total of 30,802 miles of track. The ICC granted 1,592 petitions to abandon a total of 21,596 miles of track during the same period. The ICC denied 47 petitions to abandon a total of 3,142 miles of track.¹

In South Dakota, 16 petitions for abandonment accounting for 188 miles of track were granted prior to 1940. Between 1940 and 1974, 30 abandonment petitions were granted accounting for 856 miles of track.²

As of April 22, 1977, there were six pending railroad abandonments in South Dakota. The CNW filed to abandon 172 miles of track between Winner and Norfolk, Nebraska; 156 miles of track between Iroquois and Wren, Iowa; 48 miles of track between Watertown and Doland; and 71 miles of track between Watertown and Stratford. The MILW filed to abandon 41 miles of track between Roscoe and Orient. The BN filed to abandon twelve miles of track between Hot Springs and Minnekahta.³

¹The Economic Research Service, United States Department of Agriculture and the National Area Development Institute, Lexington, Kentucky, Prelude to Legislation to Solve the Growing Crisis in Rural Transportation (Washington, D.C.: U.S. Government Printing Office, 1975), p. 27.

²South Dakota Public Utilities Commission, "The South Dakota Public Utilities Commission Presents a Report on the South Dakota Railroad Industry Yesterday and Today, Volume II," pp. 5-7.

³Based on a telephone conversation with Mr. Lloyd Wullweber, Transportation Planner, South Dakota Department of Transportation, April 22, 1977.

While six branch line abandonments are pending, there is a possibility that more petitions for abandonment may be filed. In January 1972, the ICC issued the "34-car rule." Based on ICC findings in study cases and applied statistical analysis, it was determined that on the average, 34 carloads of freight per mile of track per year are necessary to enable a railroad company to operate branch line trackage on a break-even basis.⁴ Table 3 shows the average number of carloads of freight originating and terminating per mile of track, by railroad companies in South Dakota, for the years 1972, 1973, and 1974. The average number of carloads of freight is relatively small and in many cases does not attain the "34-car" abandonment criteria established by the ICC in deciding abandonment cases. A substantial proportion of the rail trackage in South Dakota is not capable of carrying fully loaded covered hopper cars. The capacities of rail lines in 1974 are shown in Figure 1. As a result, cost efficiencies associated with the larger covered hopper cars are not available to railroad companies owning light density lines, nor to the shippers using these lines.

Statement of the Problem

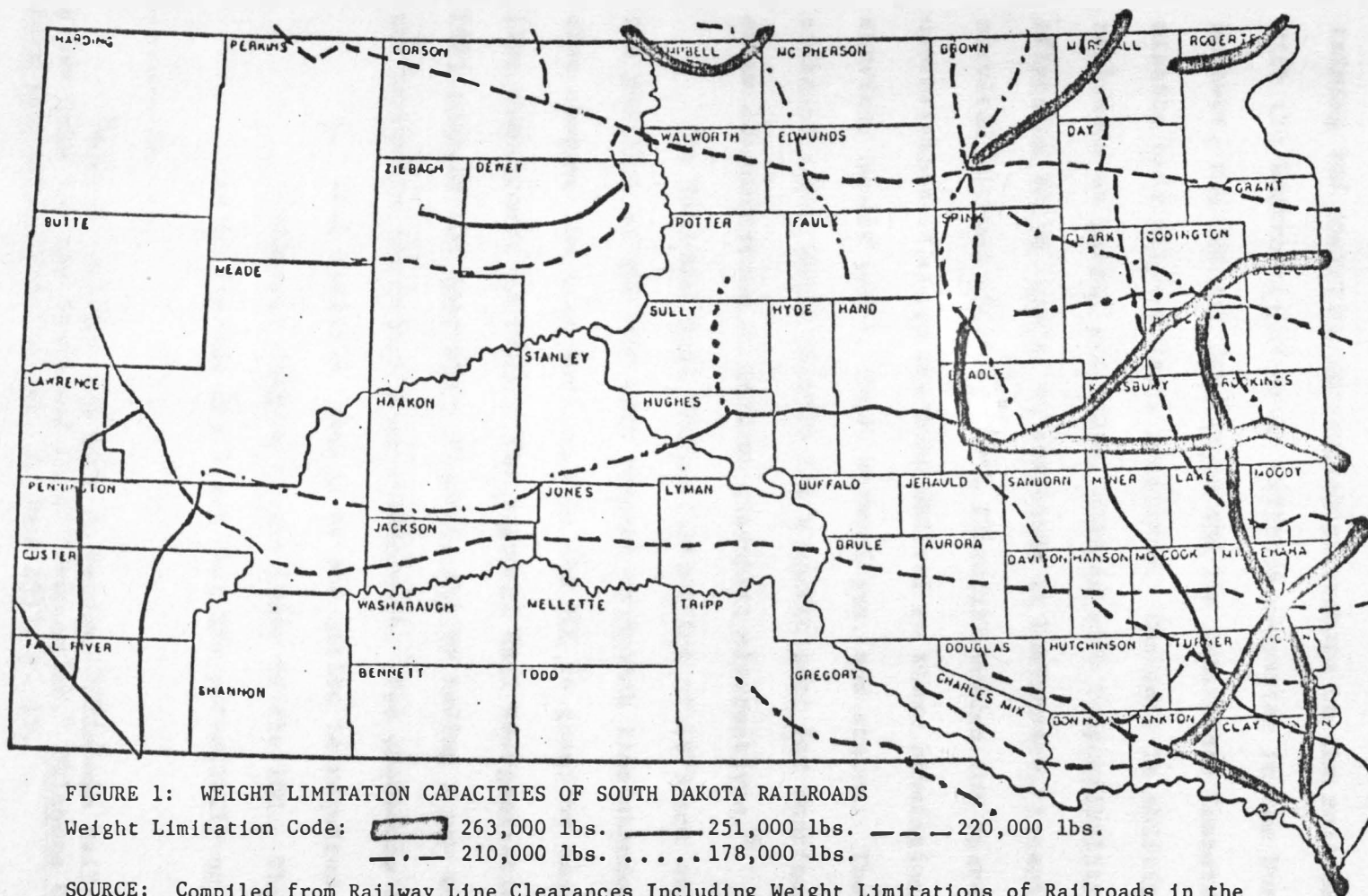
Prior to the passage of the Regional Railroad Reorganization Act of 1973, the position of the Interstate Commerce Commission and

⁴James R. Nelson, "The Economics of Railroad Abandonment," Proceedings of a Symposium on Economic and Public Policy Factors Influencing Light Density Rail Line Operations, Held at the University of Colorado, Boulder, January 10-11, 1973, p. 12.

Table 3: Carloads Originated or Terminated in South Dakota Per Mile of Track Per Year

	Carloads Originated or Terminated	Miles of Track Operated	Carloads Per Mile of Track
MILW 74	40,133	1,889	21.21
BN 74	19,396	608	31.90
CNW 74	51,218	1,293	39.84
SOO 74	2,623	70	37.47
ICG 74	6,014	21	286.38
TOTAL	119,384	3,881	30.76
MILW 73	43,534	1,917	22.70
BN 73	21,711	608	35.70
CNW 73	56,248	1,292	43.53
SOO 73	3,664	70	52.34
ICG 73	3,619	21	172.33
TOTAL	128,776	3,908	32.95
MILW 72	47,380	1,917	24.71
BN 72	16,296	609	26.75
CNW 72	50,575	1,292	39.14
SOO 72	NA	NA	NA
ICG 72	2,761	21	131.14
TOTAL	117.012	3,838	30.48

SOURCE: The annual reports to the Public Utilities Commission by the five railroad companies doing business in South Dakota. The reports were taken over the years 1972, 1973, and 1974. The data from the Soo Line Railroad Company were not available for 1972.



SOURCE: Compiled from Railway Line Clearances Including Weight Limitations of Railroads in the United States, Canada, and Mexico, No. 182, (The Railway Equipment and Publication Company, New York, New York), 1972.

the Federal Government was to place the financial burden of maintaining and operating unprofitable trackage on the railroad companies. With the bankruptcy of seven railroad companies in the Northeast, however, the Federal Government and the Interstate Commerce Commission have altered their positions. Emphasis is shifting from railroads as public utilities, charged with responsibility for effecting social goals, to railroads as businesses, incapable of survival without profits.⁵ The financial burden for operation of unprofitable trackage has been shifted to those benefiting from the service, namely users, local communities, and states. The new Act contains rules which provide for a market test for continued service after consideration of various transport alternatives.⁶

The Regional Rail Reorganization Act of 1973 not only changed the position of the ICC with respect to branch line abandonment, it also changed the procedure used by the ICC to grant or deny a branch line abandonment petition. The Regional Rail Reorganization Act of 1973 amended the Interstate Commerce Act by adding a new section on the procedure for branch line abandonment. The procedure is as follows:

1. Each railroad company in the nation is required to submit a complete diagram of its lines to the ICC. The diagram is to include any lines that are potentially up for

⁵Marc A. Johnson and Gary M. Mennem, "Oklahoma Railroads and a New Role for the State and Local Communities," Oklahoma Current Farm Economics, Vol. 48, No. 2, June 1975, p. 11.

⁶Ibid., p. 16.

abandonment. At least 120 days before an abandonment application is filed, the line must be designated as "potentially subject to abandonment" in the diagram.

2. A railroad company seeking to abandon a branch line must apply to the ICC at least 60 days prior to the proposed effective date of the abandonment. The Railroad company must also notify the governor of any affected state, citizens of the affected counties, and each shipper who has made significant use of such rail service.
3. Affected persons or groups may petition the ICC at least five days prior to the end of the 60 day period to investigate the proposed abandonment. If no such petition is received, the ICC may initiate such an investigation. If no investigation is requested by the ICC or anyone else, the ICC will allow abandonment of the line at the end of the 60 day period. The actual abandonment of the line may take place 120 days after approval by the ICC.
4. If the ICC approves the abandonment of a branch line, it is still possible to continue service if a rail service subsidy is offered. If, within 30 days of abandonment approval by the ICC, a financially responsible individual, group, or unit of government offers a subsidy sufficient to cover operating losses, the ICC will postpone abandonment for the duration of the subsidy.

The procedures outlined above provide for a prompt abandonment of

lines in which there is no shipper interest or opposition by any individual or group. At the same time, the public is given substantial prior notice of abandonment proposals.⁷

If a proposed branch line abandonment is contested by any individual or group, then the railroad company proposing the branch line abandonment and the protestants present their evidence before an ICC Administrative Law Judge in advisory hearing. Based upon the evidence heard by the Administrative Law Judge, he may grant or deny the abandonment of the branch line, or any portion of the branch line.

The Administrative Law Judge is provided with criteria for evaluating the evidence presented. Revenue attributable to a branch line is defined as all revenue from freight originating or terminating on the branch line.⁸ The ICC believes it would be desirable to develop an alternative method of determining revenue attributable to a branch line.⁹ The costs of providing branch line service are considered as the costs to the railroad company that would be avoided if branch line operation were discontinued.¹⁰ The Judge also must consider whether there will be an adverse impact on rural and community development

⁷Michael Patrick and Bernie Ferres, "Railroad Reorganization in Michigan," Michigan Farm Economics, June 1976, pp. 2-3.

⁸Federal Register, Vol. 41, No. 148, p. 31882.

⁹Ibid.

¹⁰Ibid.

as a result of the abandonment.¹¹ However, the Judge is not provided with a systematic approach to evaluate all the various aspects of branch line abandonment. A systematic approach to evaluate branch line abandonment is developed throughout this paper and is presented as a series of seven steps in Chapter V.

The results of the change in the position of the ICC and the change in the procedure to grant or deny a branch line abandonment used by the ICC are that users, local communities, and states should determine: (1) their own willingness to pay for a level of continued railroad service; (2) whether their willingness is sufficient to obtain the degree of service desired; (3) the possible adjustments with respect to other transport alternatives and their desires for these other transport alternatives; (4) whether the social benefits of branch line service exceed social costs; and (5) whether the benefits are large enough to justify continuing rail service even though private benefits fall short of private costs.

Thus the problem facing those now benefiting from rail service on branch lines up for or potentially up for abandonment is to consider whether the branch line can be operated profitably as a business. If the branch line is either marginally profitable or not profitable as a business then adjustments to alternate modes of transport need to be examined. A decision can then be made whether or not to abandon the branch line.

¹¹Ibid., p. 31879.

Evaluation of branch line abandonment has been the subject of many studies. The criteria used and method applied vary among different studies. A review of literature briefly presents the criteria, methods and conclusions of several studies.

Review of Literature

A search of available literature revealed that no studies had used the criteria of average revenue and cost, and marginal revenue and cost to analyze branch line abandonment. However, a number of empirical studies utilizing various other criteria were discovered. These studies were reviewed because they did contribute to the analysis of certain aspects of branch line abandonment cases.

The studies reviewed herein are: (1) a study to determine the impacts of the abandonment of the Chicago and Northwestern Transportation Company railroad line between Wren, Iowa and Iroquois, South Dakota; (2) a study by the Economic Research Service of the United States Department of Agriculture prepared for the United States Senate Committee on Agriculture and Forestry, which was concerned with viability of branch line operation; (3) a study by Marc A. Johnson concerned with light density lines in Michigan; (4) a study by A.R. Bunker and L.D. Hill examining the impact of rail abandonment in two selected areas; and (5) a report by the Rail Services Planning Office which evaluated a report of the Secretary of Transportation.

The Business Research Bureau of the University of South Dakota conducted an empirical railroad impact study designed to determine

the impacts on South Dakota of the proposed abandonment of the Chicago and Northwestern Transportation Company Railroad line between Wren, Iowa and Iroquois, South Dakota.¹²

Economic impacts considered were: (1) increased operating cost to farmers; (2) employment lost; (3) losses of expenditures on goods and services; (4) losses in personal income; (5) tax losses; (6) additional fuel required; (7) highway construction costs compared to railroad construction costs; and (8) effects on the environment.

Conclusions were that the abandonment of the Wren-Iroquois line would increase costs to farmers in the trade area by \$1,218,944 annually, cause a loss of 135 jobs, decrease annual direct and indirect expenditures by \$676,110, and decrease total average annual income in the trade area by \$6,368,206.¹³ Estimated cost to improve the highway system in order for the system to handle additional truck traffic was \$8,351,684. The maintenance of the highway system for the next forty years at current prices was estimated at \$27,064,843. Estimated cost to rebuild the line to Class II railroad (25 miles per hour) was \$3,009,442. Maintenance of the rail line for the next forty years was estimated at \$5,000,000.¹⁴

¹²Business Research Bureau, School of Business, University of South Dakota, Railroad Impact Study, Bulletin No. 111, July 1975.

¹³Ibid., pp. 4-5.

¹⁴Ibid., pp. 5-6.

The Economic Research Service of the U.S. Department of Agriculture prepared a study for the United States Senate Committee on Agriculture and Forestry.¹⁵ Part of this study was devoted to estimating profitability (P) of maintaining a branch rail line as a function of two variables: length of rail line (X_3) and carloads originated or terminated (X_5). For the eastern part of the United States the equations were:

$$P = 6,400 - 6,457 X_3 + 125.7 X_5 \quad (1)$$

$$P = -9,978 - 5,547 X_3 + 120.8 X_5 \quad (2)$$

The report did not include a definition of profitability, however from equations (1) and (2) it appears that profitability is operating revenue minus operating costs. Standard errors of estimate and R^2 were not given. Equation (1) was the estimate for lines up to 10 miles in length and (2) was for lines between 11 and 30 miles in length.¹⁶ Figure 2¹⁷ illustrates the relationship of line length and traffic volumes for financially viable local service operation, as was derived by the Interstate Commerce Commission and United States Department of Transportation criteria.

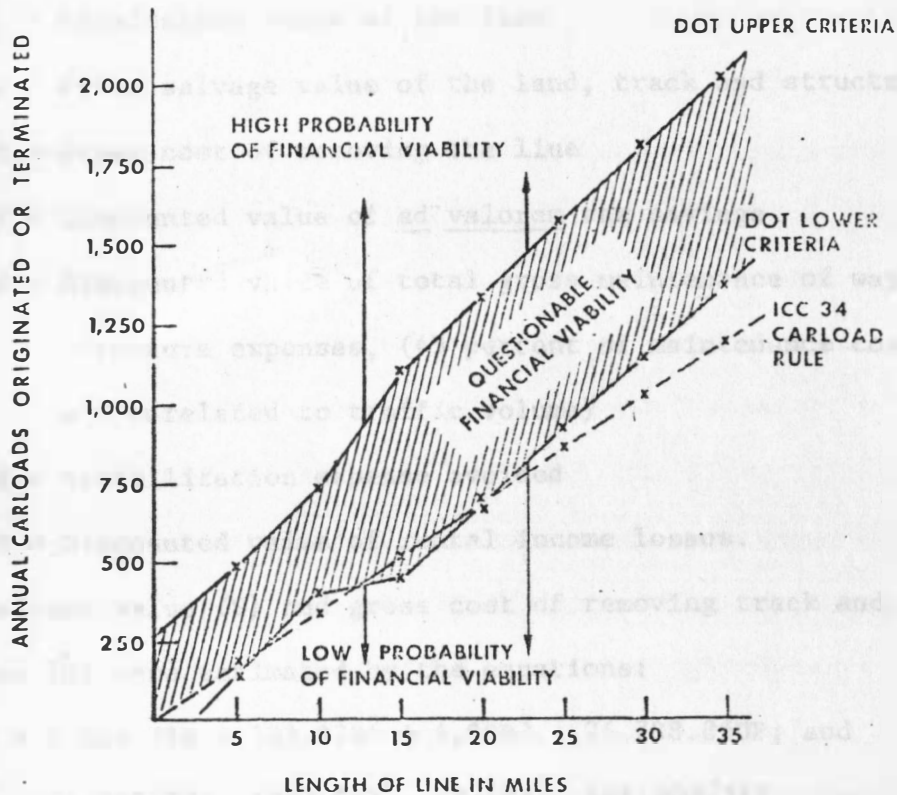
Marc A. Johnson developed a procedure for economic evaluation of light traffic density railroad branch lines.¹⁸

¹⁶Ibid., p. 24.

¹⁷Ibid., p. 24.

¹⁸Marc A. Johnson, Community Evaluation of Railroad Branch Lines: Principles and Procedures, Report No. 38, Department of Agricultural Economics, College of Agriculture and Natural Resources, Michigan State University, April 1975.

Figure 2: Relationship of Rail Line Length and Traffic Volumes for Financially Viable Local Service Operation



Source: Federal Railroad Administration Research Report OE-73-3- Development and Evaluation of an Economic Abstraction of Light Density Rail Line Operations.

Johnson used the equation, $V_L = S - C + T + .43M + H - R$ to estimate total liquidation value of a section of light density rail line in Michigan.¹⁹ The denotation of the variables was as follows:

V_L = Liquidation value of the line

S = Gross salvage value of the land, track and structures

C = Gross cost of removing the line

T = Discounted value of ad valorem tax savings

M = Discounted value of total gross maintenance of way and structure expenses, (43 percent of maintenance costs are unrelated to traffic volume)

H = Rehabilitation expense avoided

R = Discounted value of rental income losses.

Salvage value (S) and gross cost of removing track and structures (C) were estimated by the equations:

$$S = 1,634.71D + 433.97D^2 + 4.90D^3 - 26,788.85UP; \text{ and} \quad (3)$$

$$(4,391.72) \quad (243.96) \quad (3.10) \quad (41,702.21)$$

$$C = 5,504.69D + 89.21D^2 - 2.18D^3 - 51,234.82UP. \quad (4)$$

$$(1,618.33) \quad (89.58) \quad (1.14) \quad (15,141.02)$$

The length of the line in miles was denoted by D and UP denoted the location of the line. If the line was located in the Upper Peninsula, the value of UP was one (1). If the line was located in the Lower Peninsula, the value of UP was zero (0). Estimating equations for S and C were obtained by regression analysis. Standard errors of estimate are given in parentheses. No value for R^2 was given.

¹⁹Ibid., pp. 18-19.

Equations (3) and (4) do not have constant terms. Dr. Johnson did not explain why constant terms do not appear in the regression. Sample size was 23 cases. The mean distance was 17.5 miles.

A.R. Bunker and L.D. Hill studied the impact of rail abandonment on agricultural production, associated grain marketing, and fertilizer supply firms.²⁰ Bunker and Hill selected two cases for detailed study. Case I was a 95.4 mile section of line from near Oskaloosa, Iowa to Keithsburg, Illinois, abandoned in 1971. Case II was a 14.4 mile section of spur line from Guthrie Center to Menlow, Iowa.

Regression analysis was used to analyze the impact of abandonment on agricultural production.²¹ In the Case I area the loss of rail service had little or no impact on the type of agricultural production. In the Case II area, it appeared that rail abandonment increased the cost of grain exports relative to use in other agricultural enterprises, thereby causing a shift toward greater livestock production.²²

The impact on grain elevators was determined by comparing grain elevator data taken for the years 1970 and 1973. The loss of rail service to grain elevators in the Case I area did not cause a reduction in shipments of grain. However, the amount of grain shipped

²⁰A.R. Bunker and L.D. Hill, "Impact of Rail Abandonment on Agricultural Production and Associated Grain Marketing and Fertilizer Supply Firms," Illinois Agricultural Economics, January, 1975.

²¹Ibid., pp. 14-15.

²²Ibid., pp. 19-20.

to distant areas increased dramatically for elevators retaining rail service.²³

The role of barge movement as a substitute for rail service was indicated. Of the total grain shipped by elevators losing rail service, 95 and 97 percent went to locations on the Mississippi River in 1970 and 1973, respectively. Of the total grain shipped by elevators retaining rail service, 82 and 75 percent went to locations on the Mississippi River in 1970 and 1973, respectively.²⁴

The average truck capacity for elevators losing rail service increased 129 percent. The average truck capacity for elevators retaining rail service increased 33 percent.²⁵ Average employment of both the elevators losing and those retaining rail service increased slightly.²⁶ The average capital expansion for elevators losing rail service was similar to that of elevators retaining rail service.

In the Case II area, the elevators losing rail service tended to decline relative to elevators retaining rail service. Elevators losing rail service decreased grain shipments by 45 percent from 1968 to 1973. Elevators retaining rail service increased grain shipments by 147 percent. Average employment decreased for elevators

²³Ibid., pp. 15-16.

²⁴Ibid., p. 16.

²⁵Ibid., p. 16.

²⁶Ibid., p. 17.

losing service, while it increased for the elevators retaining service. Average capital expenditures by elevators retaining service greatly exceeded the average capital expenditures by elevators losing rail service.²⁷

Rail abandonment is a complex problem made difficult by the range of rail services required by users in various regions of the nation.

Each of the empirical studies reviewed provided useful insight to various specific aspects of rail abandonment in a particular state, region, or local area. With the exception of the Railroad Impact Study, the intent of the studies was not to evaluate rail abandonment in general, but rather to investigate various impacts associated with rail abandonment.

The Railroad Impact Study and the study by Hill and Bunker did not consider costs and revenues associated with branch line service which are factors endogenous to the railroad system. The Railroad Impact Study failed to consider the costs incurred by the Chicago and Northwestern Transportation Company (CNW) in providing service to the Wren-Iroquois line. Nor did the study consider the saving to the CNW by abandoning the line. Also, revenues earned by the CNW on the Wren-Iroquois line were not considered. In short, the Railroad Impact Study failed to consider what incentives the CNW may have to continue operation of the Wren-Iroquois line.

²⁷ Ibid., p. 18.

Marc Johnson's study used average costs taken from aggregate data. Average data were used because of their availability. Johnson's cost analysis was based on average costs as opposed to marginal costs. The limitations of average cost data and the importance of marginal analysis are mentioned in the introduction to Johnson's study.

This was the best information available to Dr. Johnson but the data has [sic] accounting and other limitations. Careful studies of actual off-branch costs are needed. Conceptually the appropriate costs are the added costs to the off-branch carrier resulting from the added shipment from a branch line. These are not necessarily average costs. Yet the allocation of the off-branch costs is critical in determining the subsidy requirements on a particular branch line.²⁸

The study prepared for the United States Senate Committee on Agriculture and Forestry by the Economics Research Service of the U. S. Department of Agriculture did not consider marginal costs and revenues related to branch line service. While the study did consider the effects of rail abandonment, the study did not specify the additional costs associated with the adjustments to compensate for the loss of rail service.

The Rail Services Planning Office submitted a report to the United States Railway Association which was an evaluation of the Report of the Secretary of Transportation entitled "Rail Service in

²⁸ Johnson, op. cit., foreward, written by James D. Shaffer, pp. 1-2.

the Midwest and Northeast Region."²⁹ The United States Railway Association is a nonprofit corporation whose responsibility is the planning of the basic system of rail transportation.

The following is a partial list of suggestions and considerations made in the report.³⁰

1. Branch line viability should not be based primarily upon the number of carloads handled.
2. Only a minimum amount of track should be abandoned. That trackage which is abandoned should be set aside for possible future rail use or be transferred to the public domain.
3. Railroads should receive greater federal subsidy relative to air and highway transportation.
4. Railroads should be deregulated or treated as a public utility with a guaranteed rate of return.
5. More specific data on costs of modernization and maintenance be made available and be used.
6. The capacity of a rail line is not readily subject to generalization.
7. The rail-truck breakeven distance is more near 150 miles than 200 miles.

²⁹Rail Services Planning Office, Interstate Commerce Commission, Evaluation of the Secretary of Transportation's Rail Services Report, (Washington, D.C.: U.S. Government Printing Office, 1974).

³⁰*Ibid.*, pp. 4-26.

8. All branch lines should be evaluated on an individual basis.
9. Traffic volume may have been artificially low because of car shortages or poor service.

The studies included in this review used various approaches to analyze and evaluate specific aspects or impacts of branch line abandonment. This study attempts to develop an approach which can be used to analyze and evaluate rail abandonment of branch lines based on average and marginal revenue and cost principles. Thus prepared, some effects of rail abandonment on users, local communities, and states and related adjustments to alternate modes of transportation are considered.

Purpose and Objectives

The purpose of this study is to develop a theoretical approach which could be used to evaluate potential branch line abandonments.

The first step in such a theoretical approach is to develop a method to determine profitability of a branch line operation. It includes: (1) constructing a total revenue function for revenue attributable to branch line operation, from which the corresponding average and marginal revenue functions can be derived; (2) application of traditional average and marginal cost functions to branch line operation; and (3) comparing total revenue to total cost and marginal revenue to marginal cost as constructed. Total profitability is total revenue minus total cost, and marginal profitability

is marginal revenue minus marginal cost.³¹

The second step is to develop a method to determine the change in costs and/or revenue to farmers and elevator operators as a result of branch line abandonment.

The third step is to present and discuss some social benefits and costs associated with branch line abandonment and adjustments to truck transportation as an alternative. Consideration of social benefits and costs allows those economic impacts which are not appropriately measured in monetary terms to be included in the analysis of railroad branch line abandonment. The complexity and magnitude of social costs and benefits do not permit measurement and quantification of these costs and benefits within the scope of this study. However, they are necessary conditions for a thorough analysis of branch line abandonment and must at least be identified in order that they may be considered.

The fourth step is to compare profitability of branch line operation to: (1) the change in costs and/or revenue to farmers and elevator operators as a result of branch line abandonment; and (2) the social benefits and costs associated with branch line abandonment.

The specific objectives which guide this study are:

1. To develop a method for determination of profitability of branch line operation based on costs and revenues associated with branch line operation;

³¹Total revenue is defined on page 33 and total cost is defined on page 38.

2. To develop a method for evaluation of the alternative of using truck transportation as a substitute for rail service; and
3. To present and discuss some social implications of branch abandonment, with emphasis on the role of public policy to maintain and promote desirable social ends.

Scope of the Study

Branch line abandonment is a nationwide phenomenon, however, there are economic conditions which differentiate South Dakota from the rest of the nation. For example, South Dakota's rural population is sparse compared to more heavily populated urban states. Agricultural production plays a more important role in South Dakota's economy than it does in more industrialized states.

There are a number of economic characteristics which differentiate an agricultural region from an industrial region. For example, typical inputs in an agricultural region are fuel, seed, fertilizer, feed, and implements. Products produced in an agricultural region, with the possible exception of garden vegetables and feed grains, usually require further processing. Products produced in an industrial or manufacturing region may or may not require additional processing. The market structure of agricultural commodities is different from the market structure of products produced in industrial regions.

The scope of the study is limited by analyzing branch line abandonment in an agricultural region having economic, agricultural,

and geographic conditions similar to those generally found in South Dakota.

There are factors such as climate and terrain which differentiate South Dakota from other agricultural regions. In some other agricultural regions, movement of grain by river barge is a feasible method of transport. However, under current technological conditions as found in South Dakota, trucking grain is the only feasible alternative to shipping grain by rail.

Also, for ease of analysis and presentation in Chapters II, III, and IV, it is assumed that a homogenous type of grain is the only commodity carried by rail or truck.

The approach developed in this study refers to branch line abandonment in South Dakota.

CHAPTER II

ANALYSIS OF BRANCH LINE PROFITABILITY

Introduction

The purpose of this chapter is to develop an approach which can be used to determine the profitability¹ of branch line operation, based upon average and marginal costs and revenues associated with the provision of branch line service.

A method of attributing revenues to railroad branch line operation based on revenue relationships between main and branch lines is developed. Costs of providing branch line service are analyzed based on traditional cost relationships.

A railroad company must have some incentive to operate a branch line and/or a main line. Based on profits as an incentive, there are five obvious reasons why a railroad company operates a section of line. Those reasons are:

1. It anticipates earning profits in a given period of time, say a calendar year, by providing transportation services to shippers and receivers;
2. It anticipates earning future profits by providing transportation services to potential shippers and receivers in forthcoming time periods;
3. It anticipates earning present or future profits by routing

¹The term profitability, as used denotes total operating revenue minus total operating cost.

freight over the section of line, even though little traffic originates or terminates on that line;

4. It operates an unprofitable section of line with a subsidy sufficient to cover or exceed the financial loss; and
5. It operates a section of line at a financial loss if the railroad is legally bound to do so.²

A railroad company operates a section of branch line as motivated by one or more of the above five reasons. A railroad company operating a branch line earns revenues from providing service on the branch line. However, a railroad company also incurs a variety of costs associated with the provision of branch line service. These costs include labor, fuel, maintenance, and depreciation.

The Demand for Rail Transportation Services

The demand for rail service is one factor that determines the revenues which result from operation of a railroad company. The demand for rail service refers to either an individual demand or the market demand.

In the absence of regulatory constraints, a railroad company usually has a partial monopoly.³ Monopoly results from the lack of

²Forced continuation of service resulting in insolvency constitutes confiscation of property without the due process of law, which is a violation of the Fifth Amendment. This principle is known as the Brooks-Scanlon doctrine which was upheld by the United States Supreme Court in the Case of Brooks-Scanlon vs. Railroad Commission of Louisiana, in 1920.

³Truman C. Bigham and Merrill J. Roberts, Transportation (2nd ed. New York: McGraw-Hill Book Company, 1952), p. 171.

competition with other railroads or alternative modes of transportation.

Competing modes of transportation limit any monopoly power the railroads may have, but do not entirely eliminate it. Competition from barges is restricted to navigable bodies of water. Competition from trucks has gone far in destroying railroad monopoly. However, railroads still occupy a monopolistic position with respect to some long-distance traffic bulk commodities. Competition from trucks is varied widely in significance according to the type of traffic.⁴

Some railroad traffic is monopolistic and some is competitive. The exact portion that is monopolistic is impossible to determine, but the non-competitive traffic is substantial.⁵

Monopolists and monopolistic competitors differ from purely competitive firms in only one really essential respect: they face a downward sloping demand curve for their product.⁶

Therefore, in the absence of regulation, a railroad company would have a downward demand curve.

However, rail rates are subject to regulatory constraints imposed by the ICC. In order to protect shippers from the monopoly power of the railroads, the ICC has established maximum rates which can be charged. Also in order to protect competing modes of traffic

⁴Ibid., pp. 172-3.

⁵Ibid., p. 173.

⁶F. M. Scherer, Industrial Market Structure and Economic Performance (Chicago: Rand McNally and Company, 1970), p. 13.

from predatory pricing tactics, the ICC has also established minimum rates which can be charged.

The maximum and minimum rates as established and regulated by the ICC change the shape of the demand curve for rail service. Figure 3 shows a demand (D) and marginal revenue (MR) curve for rail service under monopoly conditions.

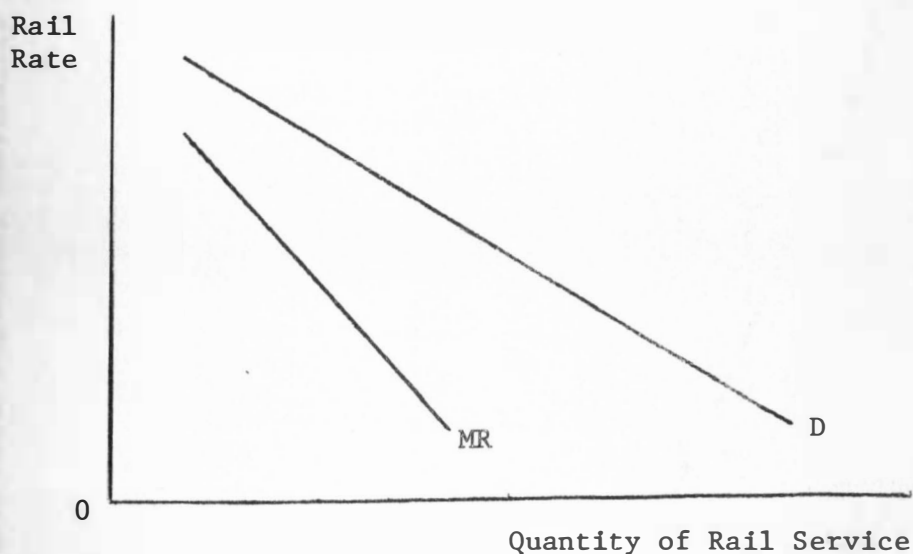
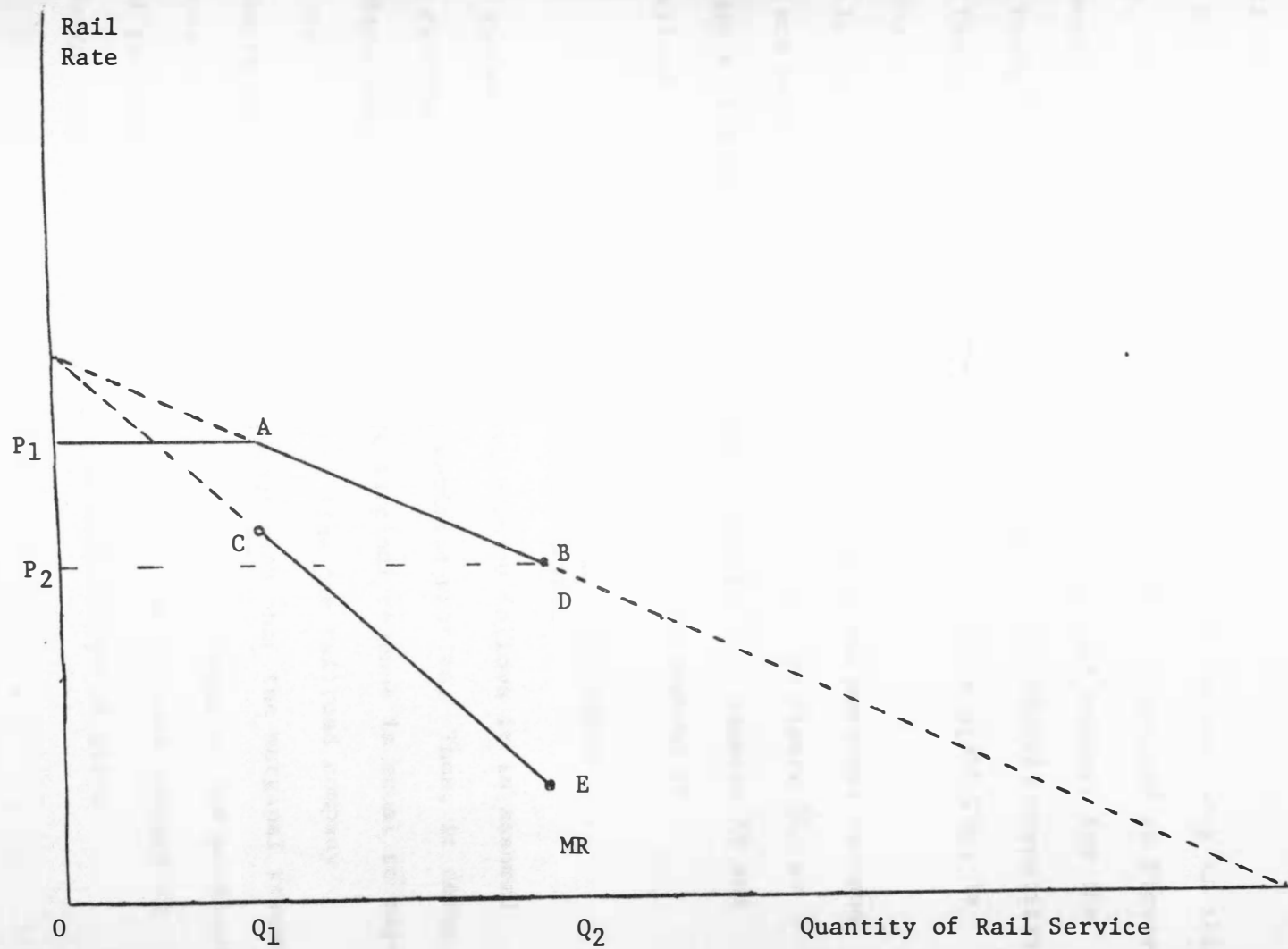


Figure 3: Monopoly Demand Curve

Figure 4 shows a monopolistic demand and marginal revenue curve subject to regulatory constraints, where P_1 is the maximum rate and P_2 is the minimum rate. Under regulatory constraint, for output Q , such that $0 < Q \leq Q_1$, the rail rate is less under regulatory constraint than would be the case in the absence of regulation. For output Q , such that $Q_1 < Q \leq Q_2$, the rail rate is determined by forces of supply and demand under competitive conditions as they exist for a railroad company.

Figure 4: Monopoly Demand Curve Under Regulatory Constraints



Output Q , such that $Q_2 < Q$ is not offered because Q_2 is the maximum output demanded at P_2 . Output in excess of Q_2 is demanded only if the rail rate is below P_2 .

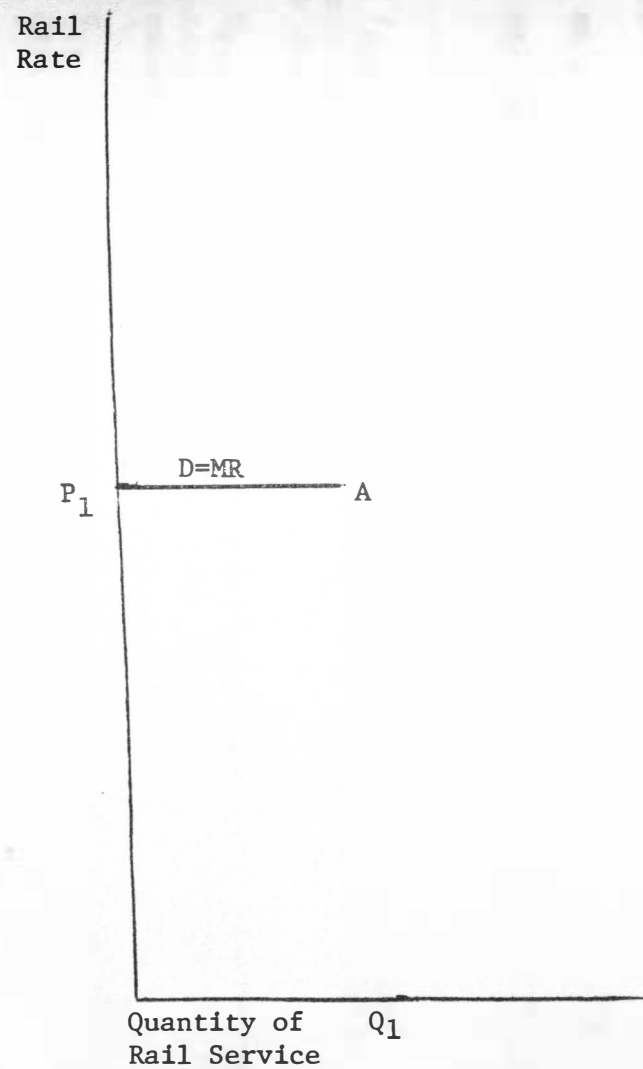
For the purpose of the long-run analysis presented later in this chapter, the demand and marginal revenue curves as presented in Figure 4 are separated into two sets of curves. One set of curves, for the output range $0 < Q \leq Q_1$, is analogous to those of a perfectly competitive firm. The second set of curves, for the output range $Q_1 < Q \leq Q_2$, is analogous to a monopolistic firm.

In Figure 5a, as in Figure 4, the demand and marginal revenue curves are both represented by line segment P_1A . In Figure 5b, as in Figure 4, the demand curve is represented by line segment AB and the marginal revenue curve is represented by line segment CE .

Assumptions Regarding the Economic Decision Making of a Railroad Company

For the purposes of the analysis which follows it is assumed that a railroad company attempts to maximize profits. Thus, it seeks to produce output at the point where marginal revenue is equal to marginal cost. Moreover, for each branch line the railroad company attempts to produce a quantity of output such that the marginal revenue attributable to operation of that branch line is equal to the marginal cost of producing that output. The output of a railroad company is considered to be the movement of a homogeneous type of grain.

a: Competitive Range



b: Monopolistic Range

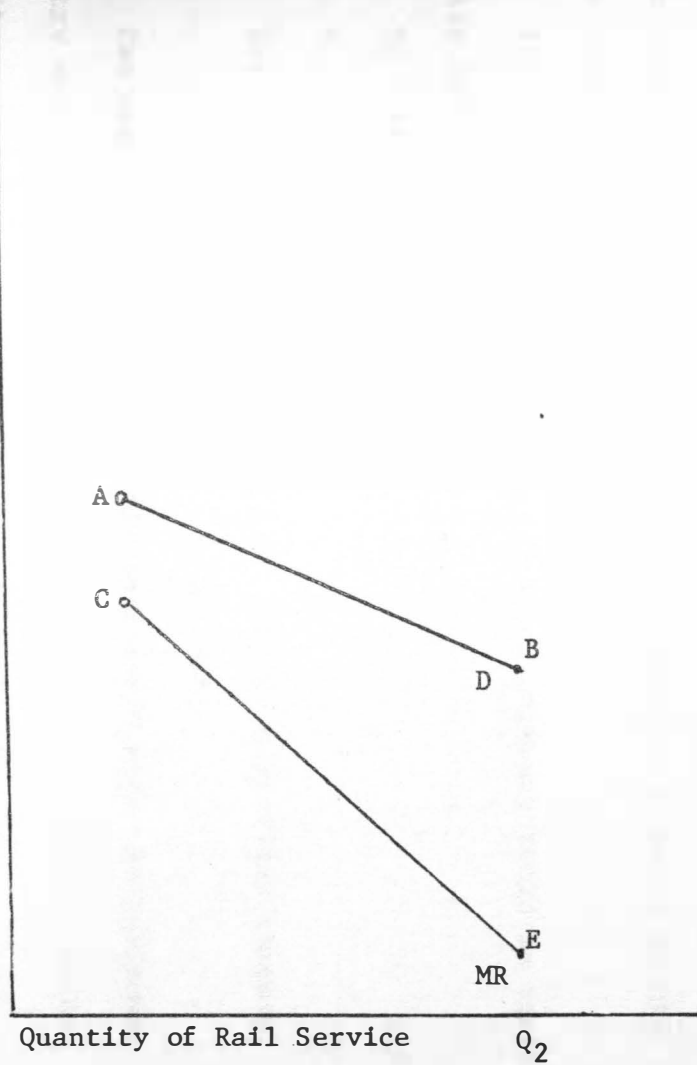


Figure 5: Demand for Rail Service Under Regulatory Constraint

Operating Revenue Generated by Providing Rail
Service Over a Section of Line

A railroad company can be regarded as producing a homogeneous output under the assumption that a homogeneous type of grain is the only commodity being carried.

Total operating revenue⁷ for a railroad company could be functionally described by:⁸

$$TR = PQ \text{ or} \quad (1)$$

$$TR = f(Q) \text{ where} \quad (2)$$

TR: total operating revenue generated by a railroad company carrying a homogeneous type of grain.

Two measures of output commonly associated with the railroad industry are ton-miles or car-miles. For the purpose of this study car-miles are the units in which output is measured.

A marginal revenue function could be derived by differentiating (2)⁹ with respect to Q and expressed as:

$$MR = f' (Q), \text{ where} \quad (3)$$

MR: marginal revenue .

⁷Some railroad companies earn revenues from enterprises other than railroad operation. For that reason, total operating revenue is used to denote revenues generated by railroad operation only.

⁸The analysis developed and used in this study could be modified and applied to a variety of commodities and aggregated to obtain results for n commodities carried by rail.

⁹It is assumed that equation (2) is a continuous function which can be differentiated.

The Contribution of a Branch Line to the Entire System

An entire system consists of all the branch and main lines operated by a railroad company. Branch lines are considered to be light density lines which connect to a main line. The primary criteria for distinguishing a main line from a branch line are length of line and freight density.

In cases where freight moves over both branch and main line trackage, it is necessary to apportion revenues generated by such freight movements between branch and main line trackage. Two methods of apportioning revenues between branch and main line trackage are cited. One method is to define the revenue attributable to a branch line as the maximum amount of revenue which could be used to defray the cost of the branch line. That maximum amount would be the total revenue of any traffic originating or terminating on the branch line minus the variable cost of moving the traffic on the main line.¹⁰

Secondly, according to the ICC,

...the revenue of the branch-line traffic is apportioned between the branch line and the main line in proportion to the mileage that it moves on the branch and the main; then 50 percent of the main line portion is assumed to be the variable cost of movement on the main line. All of the apportionment to the branch line and remaining 50 percent of the apportionment to the main line is considered as the branch line revenue.¹¹

¹⁰R. L. Banks and Associates Inc., "A Proposed Methodology," Proceedings of a Symposium on Economic and Public Policy Factors Influencing Light Density Rail Line Operations, Held at the University of Colorado, Boulder, January 10-11, 1973, p. 23.

¹¹Ibid.

A branch line generates revenue to the entire system in two ways. One way is when a shipment originates and terminates on the branch line. In this case the branch line operates independently of the main line and is responsible for 100 percent of the revenue earned from such shipments. A second way is when a shipment travels over both branch and main line trackage. In most cases a shipment does not originate and terminate on a single branch line.

There are five cases which describe the relationship of main lines and branch lines in the movement of freight.

Case 1: A freight shipment originates and terminates on the main line.

Case 2: A freight shipment originates and terminates on the same branch line.

Case 3: A freight shipment originates on a branch line and terminates on the main line.

Case 4: A freight shipment originates on a branch line, travels over the main line, and terminates on another branch line.

Case 5: A freight shipment originates on the main line and terminates on a branch line.

In Cases 3, 4, and 5, revenue generated by freight shipments is apportioned between branch and main lines.

Total revenue generated by the entire system may be considered as the sum of revenues generated by main line traffic and branch line traffic. The total revenue equation is:

$$TR_T = TR_{ML} + TR_{BL} + TR_M + TR_B^{12}$$

¹²The equation is designed to describe the relationship between one main line and one branch line.

TR_T represents total revenue generated by the entire rail system.

TR_{ML} represents total revenue generated by main line traffic, exclusive of branch lines (Case 1). TR_{BL} represents total revenue generated by branch line traffic, exclusive of the main line (Case 2).

TR_M represents total revenue apportioned to the main line as a result of traffic involving both main and branch lines (Cases 3, 4, or 5).

TR_B represents total revenue apportioned to branch lines as a result of traffic involving both main and branch lines (Cases 3, 4, or 5).

$(TR_M + TR_B)$ represents total revenues resulting from traffic involving both main and branch lines.

In order to develop a marginal revenue function for revenues attributable to branch line operation it is not necessary to consider TR_{ML} . Also for simplicity of analysis, TR_{BL} will not be considered in a marginal revenue function. There are two reasons for not considering TR_{BL} . One reason is that it is not likely that many shipments originate and terminate on the same branch line. The second reason is that TR_{BL} is quite small relative to TR_{ML} , TR_B , and TR_M .

As stated earlier, $(TR_M + TR_B)$ represents total revenue resulting from traffic involving both main and branch lines. Since $(TR_M + TR_B)$ represent revenue resulting from the same shipments, $(TR_M + TR_B)$ could functionally be described by:

$$(TR_M + TR_B) = PQ \text{ or} \tag{4}$$

$$(TR_M + TR_B) = g(Q) \tag{5}$$

The marginal revenue function for traffic involving both main and branch lines is derived by differentiating (5) with respect to Q . The marginal

revenue function would be:

$$\frac{d(TR_M + TR_B)}{dQ} = g'(Q) \text{ or} \quad (6)$$

$$MR_M + MR_B = g'(Q) \quad (7)$$

Therefore $MR_M + MR_B$ is the marginal revenue corresponding to $TR_M + TR_B$. MR_M represents marginal revenue apportioned to the main line as a result of traffic involving both main and branch lines. MR_B represents the marginal revenue apportioned to the branch line as a result of traffic involving both branch and main lines. $MR_M + MR_B$ is the marginal revenue generated by operation of the main line and branch line in combination.

If a railroad company were to abandon a branch line it would lose MR_B . If all traffic formerly originating or terminating on the abandoned line were exclusively carried by other modes, the railroad would also lose MR_M , thereby resulting in a revenue loss of $MR_B + MR_M$.

If the railroad company were to continue to carry all traffic on its main line which previously had originated or terminated on the abandoned branch line, the railroad company would lose only MR_B , which represents the revenue loss. In this case the railroad company loses only revenues attributable to the branch line. The main line would continue to generate revenues which had previously resulted from main line interaction with the branch line.

If the railroad company were to continue to carry a portion (p) of the traffic on its main line which previously had originated or terminated on the abandoned branch line, the railroad company would

lose $(1 - p)MR_M + MR_B$. The railroad company would continue to generate $MR_{ML} + pMR_M$. The loss, $(1 - p)MR_M + MR_B$, represents the contribution of the branch line to the entire system.

Therefore $[(1 - p) MR_M + MR_B]$ is considered as the marginal revenue attributable to branch line operation and is denoted as MR_C . Similarly $[(1 - p) TR_M + TR_B]$ is considered as the total revenue attributable to branch line operation and is denoted as TR_C . Also, AR_C denotes average revenue attributable to branch line operation.

Costs Incurred by the Provision of Branch Line Service

Although it is difficult to disaggregate the costs associated with the provision of branch line service, for the purpose of this study the total cost of providing branch line service is considered to be the direct and indirect costs to a railroad company of providing service on a branch line. Direct costs associated with the provision of branch line service include labor, fuel, maintenance and other costs which vary directly with output. Indirect costs are, for example, construction and maintenance of snow fences, heat and lighting of depots, and other costs which are not easily traced to output, but yet bear a relationship to output.

Average costs per unit are total cost divided by total output. Marginal costs are the additional costs incurred by producing one additional unit of output.

Fixed costs associated with the provision of branch line services are the initial cost of the track, ballast, bridges, and other

structures, depots, handling or switching facilities, maintenance costs which are independent of output, rolling stock and locomotives as apportioned to the branch line, rents or leases on property, taxes and depreciation. Variable costs associated with the provision of branch line service are maintenance costs, labor costs, fuel costs, and other operating costs.¹³

Figure 6 shows cost relationships for a railroad company.¹⁴ LRAC represents the long-run average cost curve. $SRAC_1$, $SRAC_2$, and

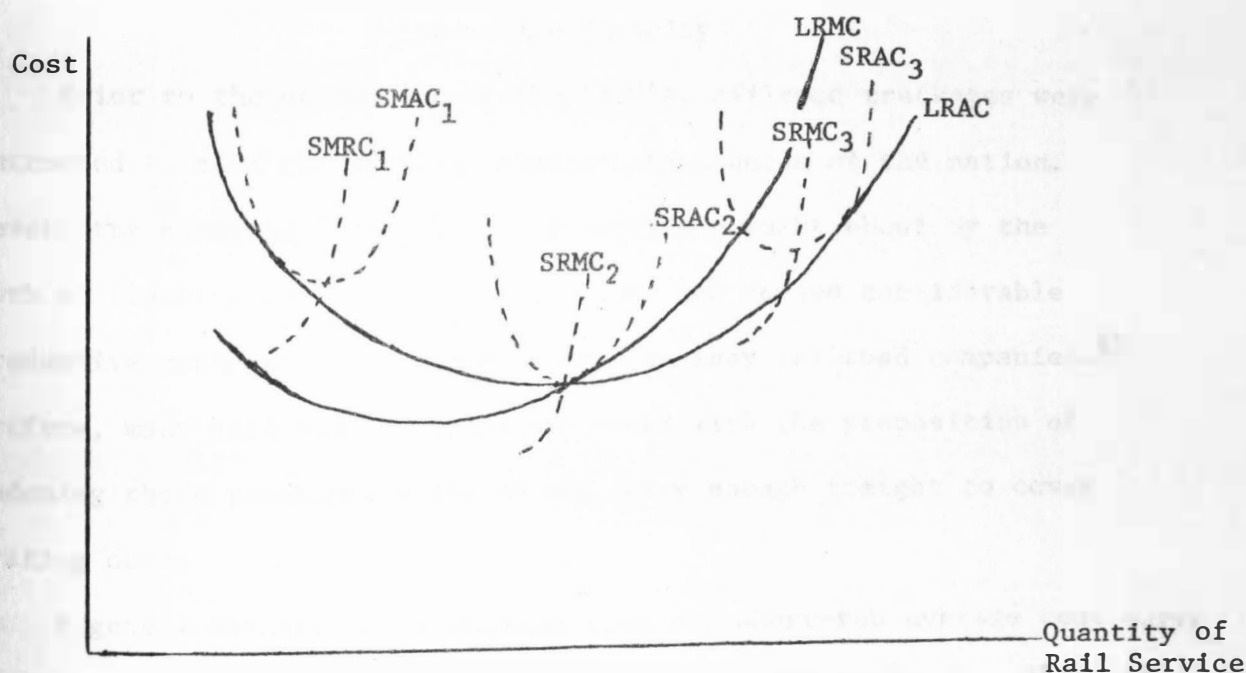


Figure 6: Long and Short-Run Average and Marginal Cost Curves for a Railroad Company

¹³See Iowa State University of Science and Technology, Ames, Iowa, An Economic Analysis of Alternative Grain Transportation Systems: A Case Study, November 1973, pp. 48-51, for a discussion of the cost of upgrading light density lines in Iowa.

¹⁴See Ann F. Friedlaender, op. cit., pp. 78-87.

and $SRAC_3$ represent short run cost curves. When a railroad company makes short-run adjustments in output, those adjustments are made without shifting to another short-run cost curve. Short-run adjustments allow only for changes in variable costs. In the short-run fixed costs remain constant. When a railroad company makes long-run adjustments in output, those adjustments are made by moving along the LRAC, which implies shifting to another short-run cost curve. Thus, long-run adjustments allow for changes in fixed, as well as variable inputs.

Unproductive Capacity

Prior to the depression of the 1930's, railroad trackages were constructed to meet the growing transportation needs of the nation. However, the changing demand for rail service brought about by the growth of trucking and technological change has caused considerable unproductive capacity and revenue losses for many railroad companies.¹⁵ Therefore, many railroad companies are faced with the proposition of abandoning those trackages which do not carry enough freight to cover operating costs.

Figure 7 illustrates a movement from one short-run average cost curve to another with a given marginal revenue curve. The shift from $SRAC_1$ to $SRAC_2$ would be the result of a decrease in plant size. In this case, the decrease in plant size would be the abandonment of a section of trackage.

¹⁵Friedlaender, op. cit., p. 20.

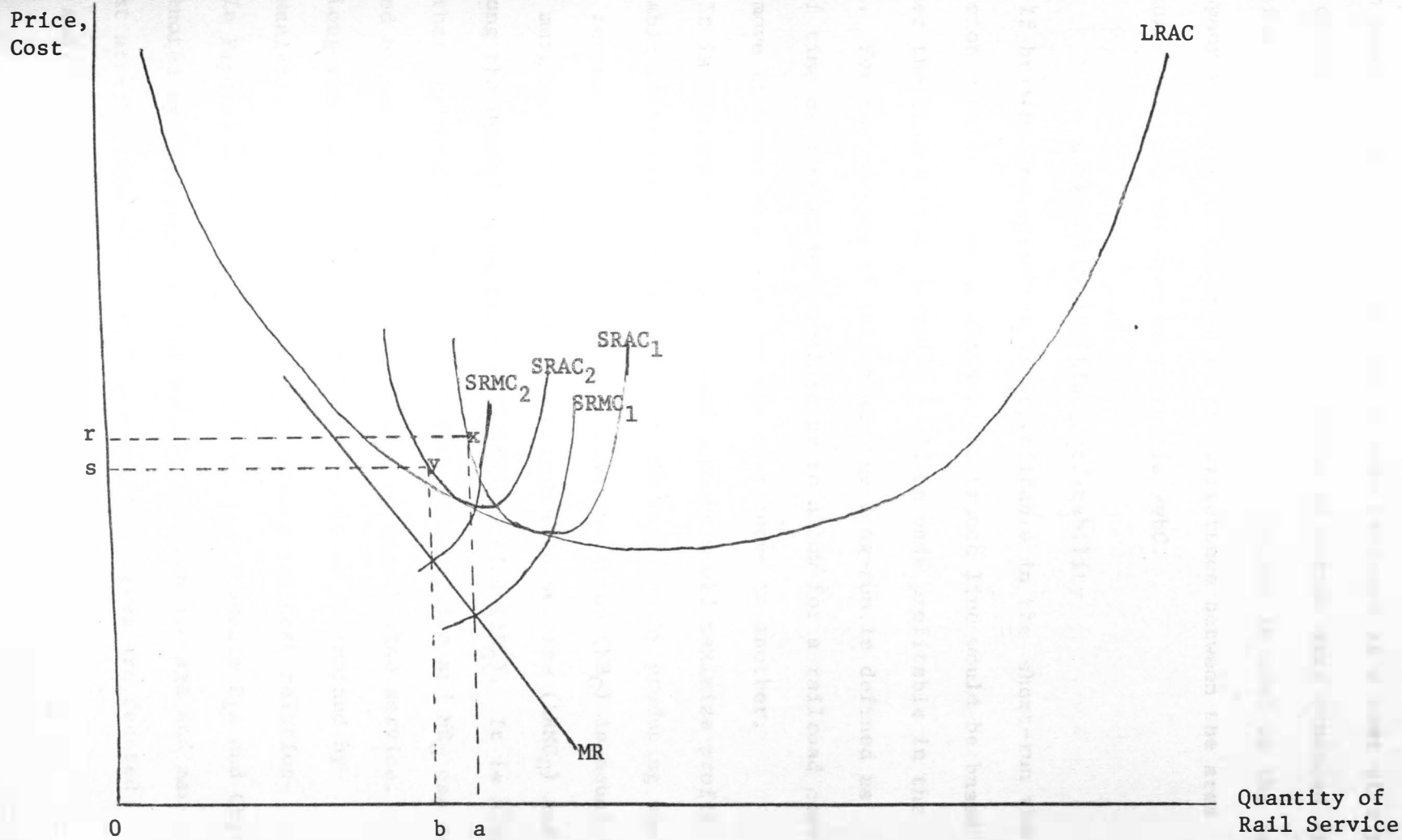


Figure 7: Movement From One Short-Run Cost Curve to Another

Prior to abandonment, a units of output were produced at a cost of r per unit of output. After abandonment, b units of output were produced at a cost of s per unit of output. The total reduction in cost to the railroad company would be represented by the difference between the area of rectangle $rx a_0$ and the area of rectangle $sy b_0$.

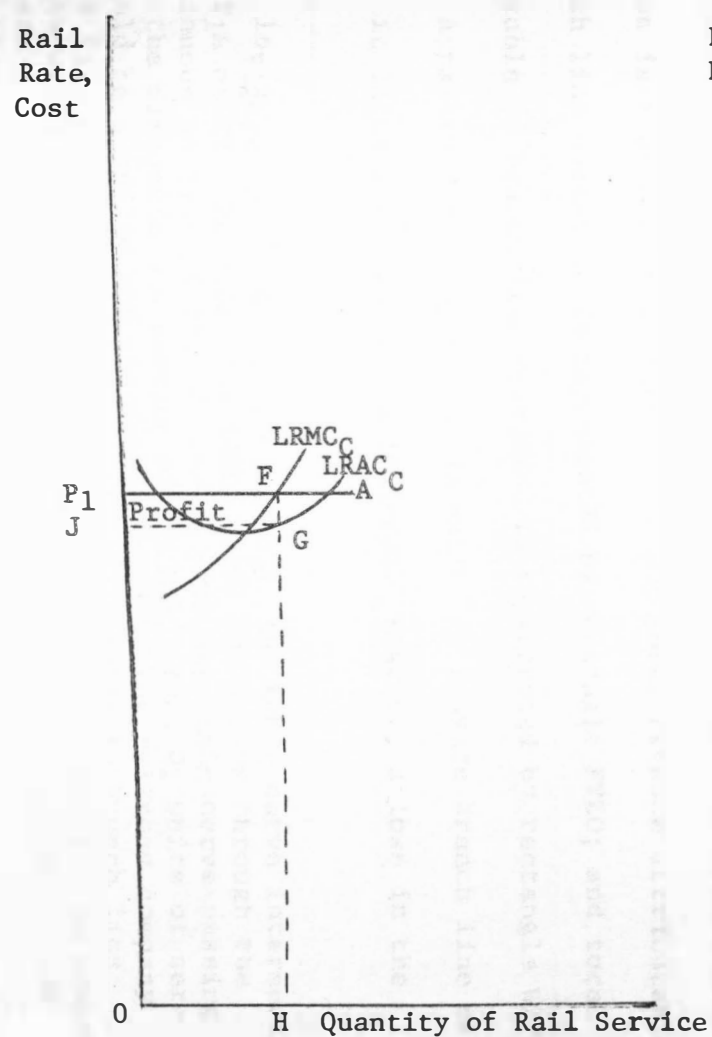
Long-Run Branch Line Profitability

If branch line operation is unprofitable in the short-run then, the decision whether or not to abandon the branch line would be based on whether the branch line operation could be made profitable in the long-run. For the purpose of this study the long-run is defined as period of time of sufficient length so as to allow for a railroad company to move from one short-run average cost curve to another.

It is assumed that the railroad company would maximize profit attributable to branch line operation in the long-run by producing where marginal revenue attributable to branch line operation (MR_C) is equal to long-run marginal cost attributable to branch line service ($LRMC_C$) and price along the demand curve for branch line service (AR_C). It is also assumed that the demand schedule for branch line service and MR_C can only be shifted by some type of subsidy to users of branch line service.

Long-run branch line profitability could be determined by graphic analysis of average and marginal revenue and cost relationships. In Figures 8 and 9 MR_C is denoted by line segments P_1A and CE ; AR_C is denoted by line segments P_1A and AB ; long-run average and marginal cost attributable to branch line operation curves are denoted by $LRAC_C$ and $LRMC_C$ respectively.

a: Competitive Range



b: Monopolistic Range

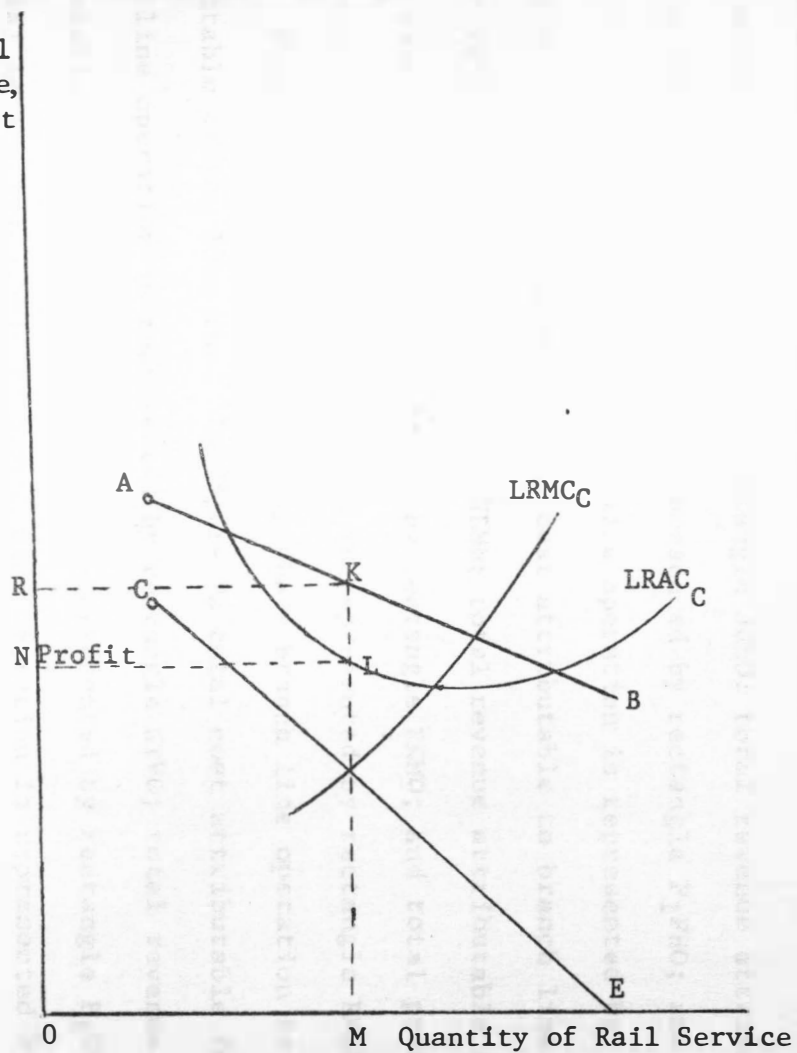


Figure 8: Long-Run Average and Marginal Revenue and Cost Curves showing a Long-Run Profit

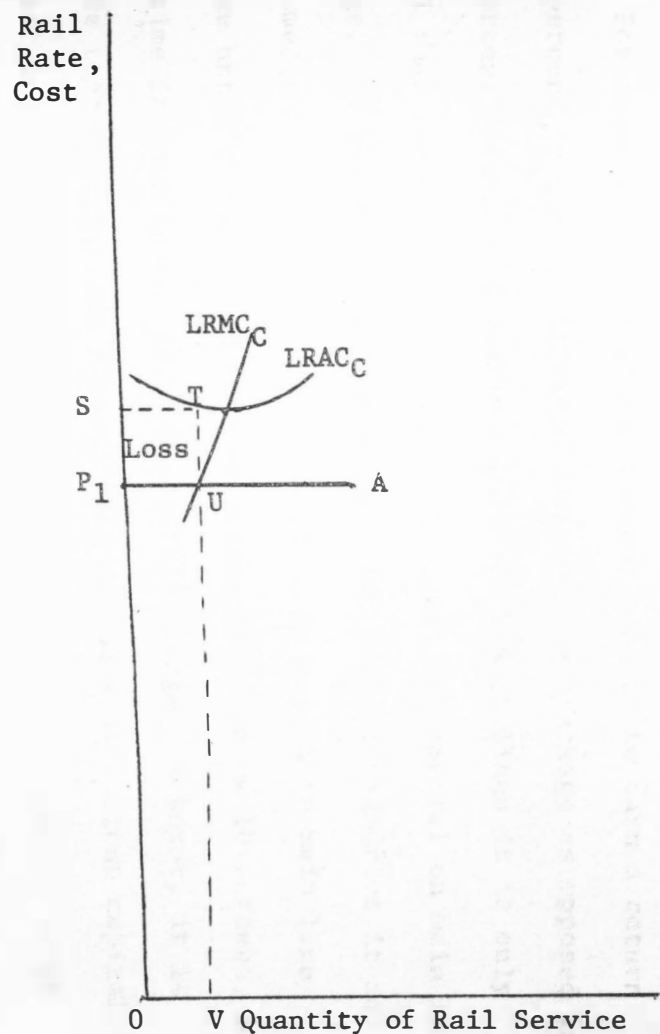
Figure 8 shows two cases where branch line operation is profitable in the long-run. In Figure 8a total cost attributable to branch line operation is represented by rectangle JGHO; total revenue attributable to branch line operation is represented by rectangle P_1FHO ; and total profit attributable to branch line operation is represented by rectangle P_1FGJ . In Figure 8b total cost attributable to branch line operation is represented by rectangle NLMO; total revenue attributable to branch line operation is represented by rectangle RKMO; and total profit attributable to branch line operation is represented by rectangle RKLN.

Figure 9 illustrates two cases where branch line operation is unprofitable in the long-run. In Figure 9a total cost attributable to branch line operation is represented by rectangle STVO; total revenue attributable to branch line operation is represented by rectangle P_1UVO ; and total loss attributable to branch line operation is represented by rectangle STP_1U . In Figure 9b total cost attributable to branch line operation is represented by rectangle WXZO; total revenue attributable to branch line operation is represented by rectangle FYZO; and total loss attributable to branch line operation is represented by rectangle WXYF.¹⁶

A railroad company has no incentive to provide branch line service if it incurs a loss in the long-run. However, a loss in the

¹⁶Figures 8 and 9 are drawn so that the $LRMC_C$ curve intersects either P_1A or CE . However, the $LRMC_C$ curve could pass through the discontinuous portion of the MR_C curve. For any $LRMC_C$ curve passing through the discontinuous portion of the MR_C curve, Q_1 units of service would be supplied and the rate charged by the railroad company would be P_1 . Long-run profit or loss attributable to branch line operation would be P_1 . Long-run profit or loss attributable to branch line operation would be determined by the relative locations of the AR_C and $LRAC_C$ curves.

a: Competitive Range



b: Monopolistic Range

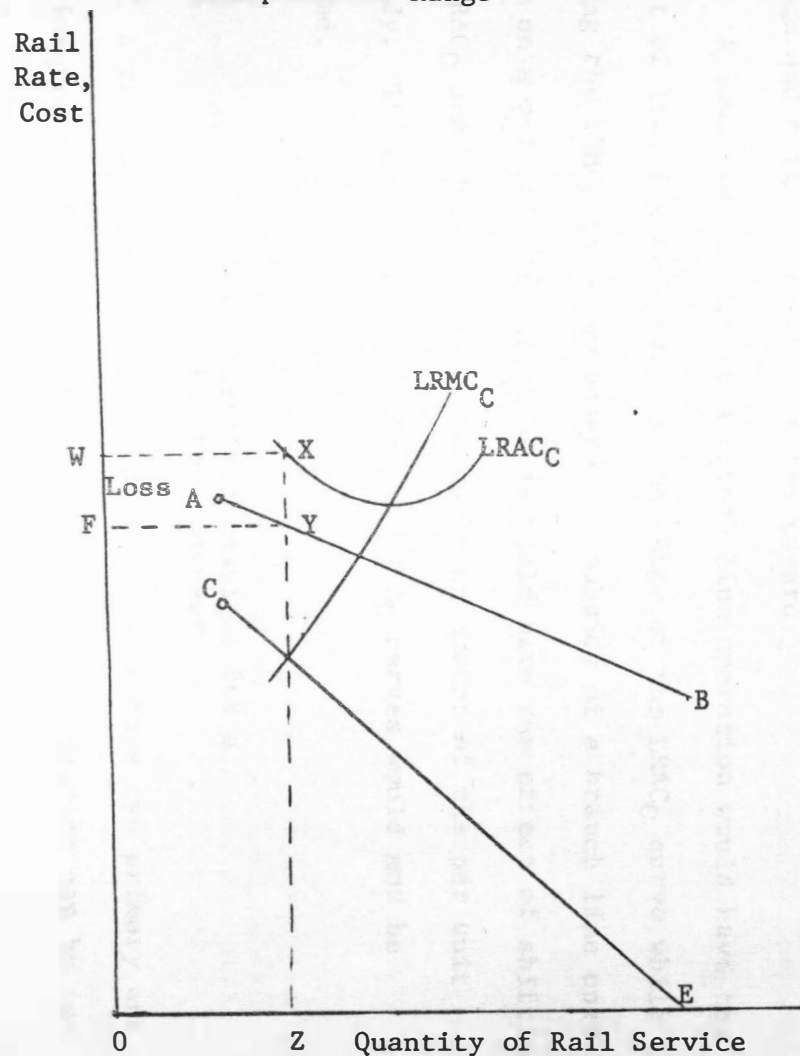


FIGURE 9: Long-Run Average and Marginal Revenue and Cost Curves Showing a Long-Run Loss

long-run could be offset by some type of subsidy. A subsidy to users of branch line service would have the effect of shifting the long-run average and marginal revenue curves upward.

A lump-sum subsidy of a branch line operation would have the effect of lowering and changing the shape of the $LRAC_C$ curve while leaving the $LRMC_C$ curve unchanged. A subsidy of a branch line operation on a per unit of output basis would have the effect of shifting the $LRAC_C$ and $LRMC_C$ curves downward by an amount of the per unit subsidy. The shape of the $LRAC_C$ and $LRMC_C$ curves would not be changed.

Investment Alternatives for a Railroad Company

A railroad company can be considered to have two primary outlets for capital invested internally. Capital resources can be invested on main line trackage or branch line trackage.

For example, if a railroad company expects to earn a return of 20 percent on capital invested on main line trackage as opposed to a 10 percent return on invested capital on branch lines it is only logical that the railroad company will invest its capital on main line trackage. If the railroad company has vast capital resources it may be assumed that the railroad will continue to invest in main line trackage until the expected rate of return falls below 10 percent, at which time it will invest in branch line trackage. However, it is possible that the railroad company does not have sufficient capital in order to carry investment on main line trackage to the point where the

expected rate of return is less than 10 percent. If such is the case the railroad company cannot be expected to invest its capital on branch line trackage unless the railroad company receives a subsidy for branch line operation large enough to cause the rate of return on branch line investment to be at least equal to the rate of return expected from investment on main line trackage.

A study of financial conditions prior to bankruptcy of seven bankrupt railroads indicated that those railroads did have a shortage of funds.

Cash flow problems did not result from unusual obligations to repay maturing debts. Debts were maturing at a constant and moderate rate for most of the seven companies. The problem rested with inability of railroads to generate revenues sufficient to cover the daily costs of running the business, in exclusion of concern for repaying debts.¹⁷

Some railroad companies have chosen to invest funds in enterprises other than railroad operation. The Burlington-Northern Railroad Inc. owns companies and subsidiaries engaged in the sale of lumber products, development of petroleum and other natural resources, motor carrier activities, air freight forwarding, fixed base aircraft operations, and real estate development. The Chicago and Northwestern Transportation Company, Inc. owns companies and subsidiaries engaged in transportation communications and real estate.¹⁸ Those railroad

¹⁷Marc A. Johnson and Gary M. Mennem, "Oklahoma Railroads and A New Role for the State and Local Communities," Oklahoma Current Farm Economics, Vol. 48, No. 2, June 1975, p. 12.

¹⁸Moody's Investors Service, Inc., Moody's Transportation Manual, 1975 (New York: William O. Dwyer, 1975).

companies having other avenues for investment will invest in those enterprises yielding the greatest expected return. If a railroad company anticipates earning a greater return on investment made outside the railroad industry than investment made within the railroad industry, the railroad company would invest funds outside the industry until the anticipated rate of return were the same for all investment possibilities.

Summary

The United States Department of Transportation (DOT) and the Interstate Commerce Commission (ICC) have developed criteria for financial viability of branch line operation. The DOT and ICC criteria discussed in the Review of Literature represent average conditions for financial viability of branch line operation and provide an easily perceptible standard by which branch line abandonment may be considered.

Following the approach developed in this chapter, branch line profitability for any length of time can be determined by comparison of revenues and costs attributable to branch line operation.

If a branch line operation is not profitable in the short-run, the decision by a railroad company to abandon the branch line would be based on whether the branch line operation would be profitable in the long-run. If branch line operation were profitable in the long-run, the railroad company would have incentive to operate the branch line. However, if branch line operation were unprofitable in the long-run, the railroad company would have no incentive to operate the branch

line unless the operation were subsidized. There are two ways in which the branch line could be subsidized. One way is to subsidize users of branch line service. A practical way in which to subsidize users is for the unit of government that subsidizes the users to pay a portion of the rail freight rate charged to the users of branch line service. The effect of such a subsidy would be an upward shift of the long-run demand and marginal revenue curves for revenues attributable to branch line operation. A second type of subsidy would be the subsidization of the railroad company. Such a subsidy could be made either on a per unit of output basis or a lump sum subsidy, independent of the level of output.

Whether or not a branch line operation is subsidized and the amount of the subsidy is dependent upon three factors. One factor is the magnitude of the financial loss to the railroad company if it were to continue to operate an unsubsidized branch line. The second factor is the cost of using truck transportation as an alternative to rail transportation. The third factor is the social implications of branch line abandonment. The second and third factors would determine a maximum amount of subsidy. If that subsidy were enough to cover the financial loss to the railroad company, then the branch line operation would be subsidized.

CHAPTER III

THE COSTS ASSOCIATED WITH THE ALTERNATIVE OF TRUCKING

Introduction

The purpose of this chapter is to evaluate the alternative of trucking in order that the costs of using trucks as a substitute for rail service can be compared to the profitability of a branch line operation as developed in Chapter II. The costs of trucking as an alternative to rail will be considered as the increase in costs or decrease in revenue to farmers and elevator operators resulting from increased use of trucking. The factors discussed in this chapter would be taken into account in determining the amount of subsidy offered to a branch line operation.

It is assumed that the total amount of grain moved (G_T)¹ in any one time period is given. G_T could be expressed as $p(G_T) + (1-p)(G_T)$, where p represents the portion of G_T moved by truck and $(1-p)$ represents the portion of G_T that is moved by rail. An increase in the use of trucks as a substitute for rail service would cause p to increase.

If branch line abandonment takes place the change in total cost of moving grain from farm to country elevator and from country elevator to final destination (ΔC) could be expressed as:

$$\Delta C = \Delta C_F + \Delta C_E, \text{ where}$$

ΔC_F = the change in total cost to all farmers resulting from the movement of their grain from the farm to an elevator

¹ G_T is expressed in car-miles.

ΔC_E = the change in total cost to all elevator operators resulting from the movement of grain from the country elevators to the final destination.

$\Delta C_F + \Delta C_E$ represent cost changes for a period of one year. In order to compare $\Delta C_F + \Delta C_E$ to unprofitability of branch line operation as developed in Chapter II, it is necessary to sum $\Delta C_F + \Delta C_E$ over the number of years that are considered in the long-run analysis in Chapter II. $\Delta C_F + \Delta C_E$ summed over long-run conditions are denoted by $\Delta LRCF + \Delta LRC_E$. Likewise ΔC in the long-run is denoted as ΔLRC .²

It may be the case that it is cheaper to move grain by truck than by rail. If such is the case, grain would be moved by truck whether or not branch line abandonment took place; therefore, rail abandonment relative to the movement of grain would be of little consequence.

Impact and Incidence of a Freight Rate Increase

If branch line abandonment results in elevator operators paying higher freight rates to move grain from country elevators to the respective final destinations, then a method for determining the incidence of such a rate increase can be determined based on competitive conditions involving the buying and selling of grain by the individual country elevator operators.

² ΔC , ΔC_F , ΔC_E , ΔLRC , $\Delta LRCF$, and ΔLRC_E are positive when there is a net increase in cost, and negative when there is a net decrease in cost. For example, if ΔC_F represents an increase to all farmers of \$100,000, and ΔC_E represents a savings to all country elevators of \$75,000, then $\Delta C = \$100,000 + (-\$75,000) = \$25,000$.

Figures 10 and 11 illustrate the change in price of grain received by a country elevator operator resulting from an increase in freight rates. Figure 10 shows a case where the demand for grain at the final destination is perfectly elastic. Figure 11 shows a case where the demand for grain at the final destination is not perfectly elastic.

If a freight rate increase causes S_1 to shift to S_2 , then under demand conditions as illustrated in Figure 10, quantity supplied is reduced from Q_1 to Q_2 while price (P_1) remains unchanged. The same shift from S_1 to S_2 under demand conditions as illustrated in Figure 11 reduced quantity supplied from Q_3 to Q_4 while price increases from P_3 to P_4 .

Whether an elevator operator can pass the increase in freight rates back to farmers selling grain is dependent upon the supply of grain to that elevator. If competitive conditions are such that there is an inelastic supply of grain to that elevator, as illustrated in Figure 12, then the elevator operator could reduce his demand to D_1 which would result in a lower price of P_1 . Quantity sold remains unchanged. However, if there is a more elastic supply of grain to the elevator, as illustrated in Figure 13, and the elevator reduces his demand to D_2 , price paid is reduced to P_2 and quantity sold reduced to Q_2 . If such is the case, the elevator operator may not do a sufficient volume of business to maintain a profit margin. Therefore, the elevator operator may elect to absorb part of the increase in freight costs and not reduce his demand for received grain.

Figure 10: Supply Shift with a Perfectly Elastic Demand Curve

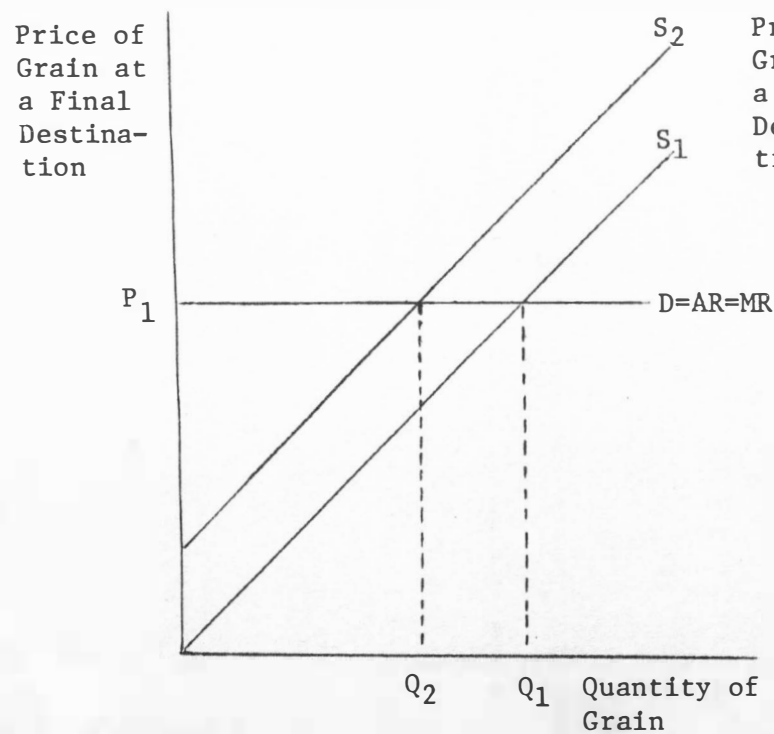


Figure 11: Supply Shift with an Inelastic Demand Curve Relative to Figure 10

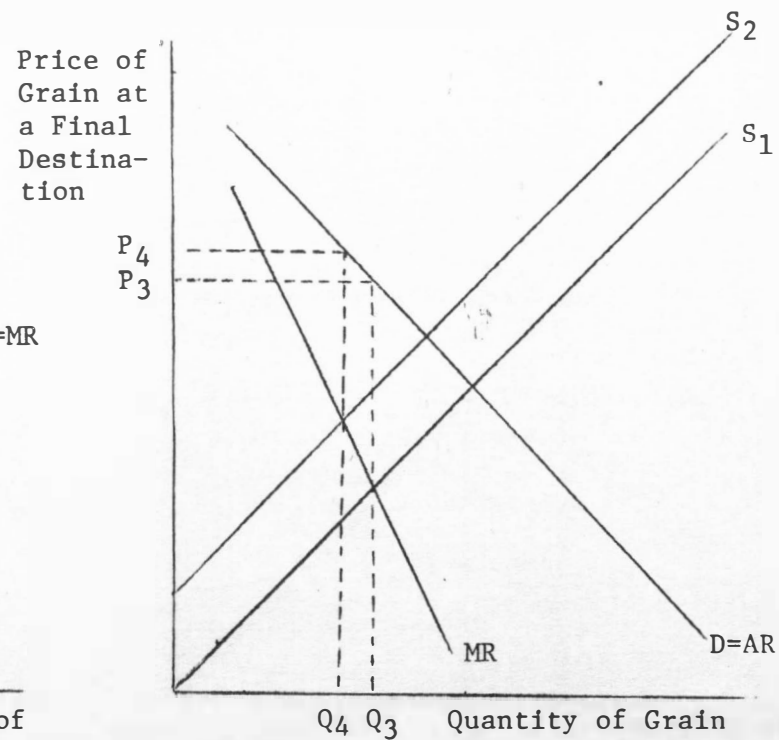


Figure 12: Demand for Grain at a Country Elevator with a Perfectly Inelastic Supply Curve

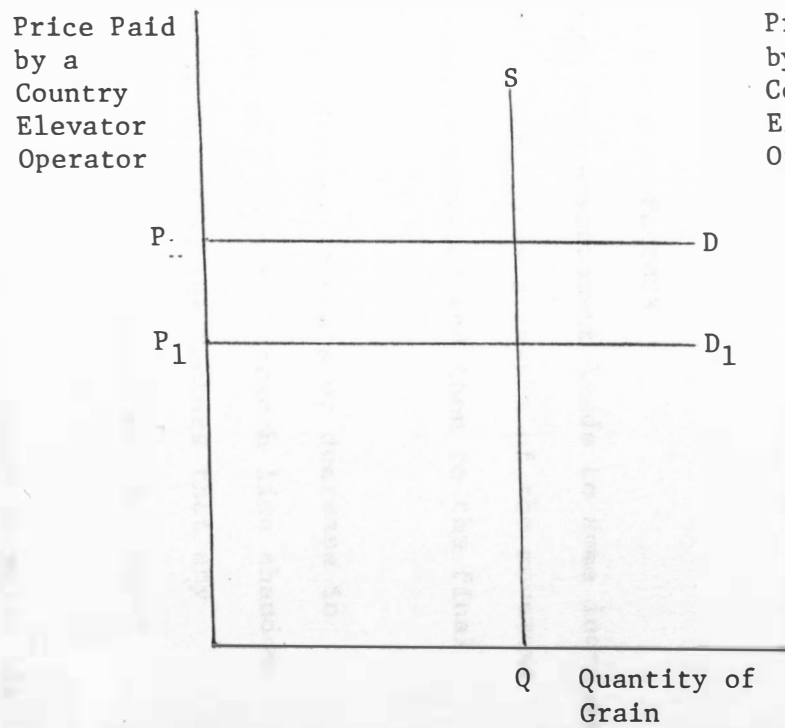
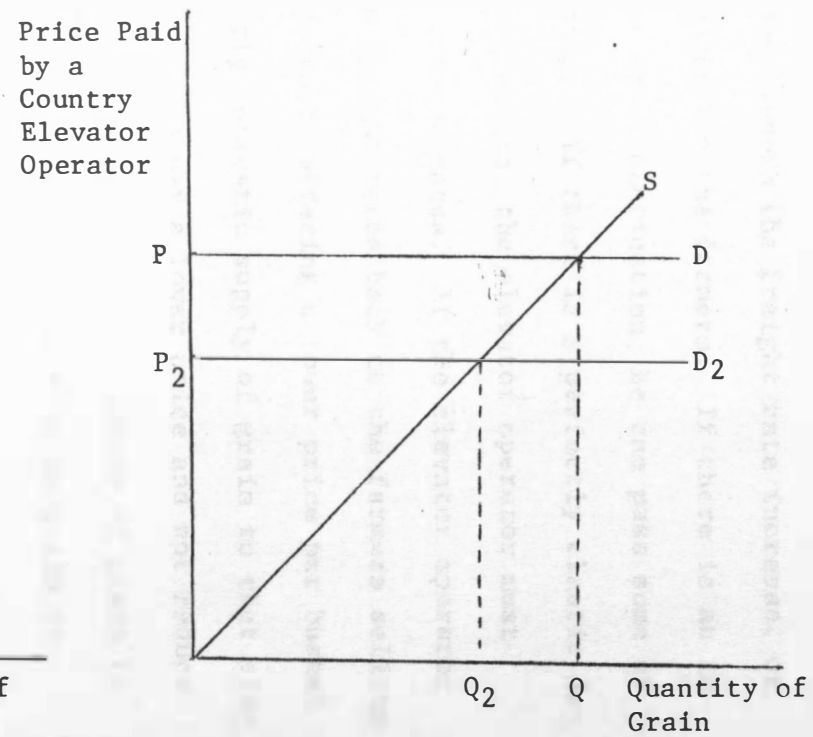


Figure 13: Demand for Grain at a Country Elevator with a less Inelastic Supply Curve



To summarize, an elevator operator has three options with respect to an increase in freight rates. He may pass a freight rate increase forward to the purchaser, absorb the freight rate increase, or pass the freight rate increase back to the farmers. If there is an inelastic demand for grain at the final destination, he can pass some of the cost forward to the purchaser. If there is a perfectly elastic demand for grain at the final destination, the elevator operator must absorb all of the increase in freight rates. If the elevator operator wishes to pass the increase in freight rates back to the farmers selling grain to the elevator he can do so by offering a lower price per bushel for grain. If there is perfectly inelastic supply of grain to that elevator, then the elevator operator can pay a lower price and not reduce quantity of grain received. If there is an elastic supply of grain to that elevator then the elevator experiences a reduction in grain received by paying a lower price for received grain.

Increased Costs to Farmers

It is assumed that branch line abandonment leads to some increase in costs or decrease in revenue to farmers as a result of the movement of grain from the farm to the country elevator and then to the final destination.

In order to determine the increase in costs or decrease in revenue experienced by all farmers as a result of branch line abandonment (ΔC_F) it is necessary to first consider the factors that any individual farmer takes into account when deciding at which country elevator he will sell his grain.

Any farmer bases his decision as to which elevator he sells his

grain to on many considerations. Some of those considerations are price per bushel received, cost per bushel to transport the grain to the elevator, quality of service, proximity to other trade centers, and established trade patterns. It is difficult to determine the degree to which any of the above mentioned considerations influence the farmer's decision as to where to sell his grain.

Under the condition of ceteris paribus it is assumed that a farmer would act in a rational manner by maximizing net price per bushel (NPB). Net price per bushel could be defined as follows:

$NPB = P - B$, where

P = price received per bushel; and

B = cost per bushel to the farmer of moving his grain from the farm to an elevator.

Whether or not a farmer owns the vehicle by which his grain is transported to the country elevator, the farmer does incur costs in moving his grain to a country elevator.

If a farmer has his grain trucked from his farm to an elevator, then the cost to the farmer may be considered as the fee charged by the trucker. The fee charged by a private trucker would most likely be directly related to distance of haul. However, a private trucker may discount the fee on grain going to a particular location if there are possibilities of securing backhauls or additional freight at that location.³

³These possibilities were pointed out to me by Mr. Pat Springer, Rate Analyst, South Dakota Public Utilities Commission.

If a farmer trucks his grain with his own truck, it is difficult to assign an exact cost for moving grain to the farmer. Factors such as the farmer's imputed wage based upon the time taken to make the trip to the elevator, depreciation of the truck, and apportionment of the cost of the truck to the various purposes it serves make it difficult to assign a specific cost.⁴ For the purpose of this analysis it is assumed that the farmer is aware of the costs of moving his grain to various elevators using his own truck.

If a farmer has an option of selling his grain to any of n elevators, then the farmer would sell his grain at one elevator in favor of another elevator based upon increase in NPB. For example, let $NPB_n = P_n - B_n$ denote net price per bushel received at the n th elevator (E_n). If $NPB_1 > NPB_2$, then the increase in NPB at E_1 over E_2 would be $NPB_1 - NPB_2$. If $NPB_1 = NPB_2 = \dots NPB_n$, then there would be no increase in NPB at one elevator over another. If such is the case the farmer would base his decision as to where to sell his grain on factors not considered in this analysis.

If $NPB_1 > NPB_2 > \dots NPB_n$, then a farmer would sell his grain at E_1 because of the increase in NPB_1 over any other NPB. If rail abandonment causes NPB_1 to decrease to NPB'_1 then relative to NPB_2 at E_2 , the farmer would sell his grain at E_1 or E_2 depending on the relationship between

⁴For an attempt to assign specific costs to the cost of moving grain by truck see Kenneth W. Keehn, The Cost of Assembling Grain in South Dakota, Unpublished Master's Thesis. Economics Department, South Dakota State University.

NPB_1 and NPB_2 . If $NPB_1' > NPB_2$, then the farmer would continue to sell his grain at E_1 . The increased cost per bushel to the farmer would be $NPB_1 - NPB_1'$. The total increase in cost to the farmer would be $(NPB_1 - NPB_1')$ multiplied by the number of bushels sold. If $NPB_2 > NPB_1'$, then the farmer would sell his grain at E_2 . The increased cost per bushel to the farmer would be $NPB_1 - NPB_2$. The total increase in cost to the farmer would be $(NPB_1 - NPB_2)$ multiplied by the number of bushels sold.

ΔC_F could be found by aggregating the total increase in cost to each farmer.

There are many options available to or adjustments which can be made by farmers doing business with a country elevator about to lose rail service, assuming the country elevator manager continues operation by trucking grain. A list of options or adjustments would include:

1. Farmers can continue to do business at the same country elevator thereby receiving a price for their grain partially based on trucking rates instead of rail rates;
2. Farmers can truck their grain to other elevators or to the final destination, thereby incurring the additional cost of trucking their grain a greater distance;⁵

⁵There may be cases where some farmers do business with an elevator which is not the country elevator closest to the farmer's operation. If farmers do not do business with the country elevator nearest them, then doing business with another elevator would not necessarily imply that they would be trucking their grain a greater distance.

3. Farmers can change their operations in such a way that they are less dependent upon rail transportation to market their products; and
4. Farmers can unite to collectively transport, market, or store their products.

Change in Costs to Elevator Operators

If rail service is discontinued by branch line abandonment and the elevator continues operation, then grain must initially be moved by truck from the country elevator. An elevator operator wishing to continue doing business after losing rail service would most likely ship grain by semi-truck. There are generally two ways in which grain can be moved by semi-truck from a country elevator to its destination. One way is for grain to be trucked the entire distance to its final destination. A second way is for grain to be trucked to an intermediate point, from which it can be shipped by rail to its destination.

The price paid for grain by any country elevator is dependent on many factors. One of those factors is the freight rate charged to the country elevator to transport grain to the next destination.

The price paid for grain by a country elevator could be represented by $P_E = P_F - R_R - H - N$ or $P_E = P_F - R_T - H - N$, where:

P_E = price per bushel paid to a farmer by the country elevator;

P_F = price per bushel received by the country elevator;

R_R = rail freight rate per bushel from the elevator to the

next destination;

R_T = truck freight rate per bushel from the elevator to the next destination;

H = handling cost per bushel incurred by the country elevator;
and

N = profit margin per bushel earned by the country elevator.

If grain shipped from a country elevator to the next destination travels by both truck and rail, then the price paid to farmers by the country elevator could be represented by $P_E = P_F - qR_R - (1-q)R_T - H - N$, where q represents the portion of the total distance that the grain is transported by rail. Similarly, $(1-q)$ represents the portion of the total distance the grain is transported by truck.

In some cases grain received at a destination is discounted if it is brought in by truck.

Truckers in South Dakota also may face additional difficulties because of the continuation of "truck discounts" at the terminal markets. Several of the elevators surveyed...indicated that trucks were still being discounted by 4 to 20 cents per bushel.⁶

If R_R and R_T are relatively close, then loss of rail service would be of little consequence to elevator operators. However, if R_T is significantly larger than R_R then elevator operators losing rail service would be faced with a decision as to how much to pay for received grain. If the elevator wishes to pay the same price for received grain, then either price received per bushel by the country

⁶Richard K. Rudel and William F. Payne, "Moving Grain in '75," reprinted from South Dakota Farm Research, Vol. 26, No. 1, 1974.

elevator operator would have to increase by $R_T - R_R$ or handling cost per bushel and profit margin per bushel would have to decrease by $R_T - R_R$. Also, an increase in P_F and decreases in H and N could act in combination to offset the increase from R_R to R_T . Essentially if an elevator operator wishes to pay the same price per bushel for received grain after experiencing an increase in freight rates, he must offset the increase by either receiving more per bushel for grain that he sells; reducing handling cost per bushel; or reducing profit margin per bushel. By doing so the elevator operator is either absorbing the increase in freight costs or passing that increase on to whoever purchases grain from the country elevator.

An elevator manager could also offset an increase in freight rates by paying less for received grain. If such is the case the elevator manager would reduce P_E by an amount equal to $R_T - R_R$. By doing so the elevator operator is keeping P_E , H , and N constant. If an elevator operator pays less for received grain he may experience a decrease in the volume of received grain. By decreasing P_E , the elevator operator is passing the increase in freight rates back to the farmer.

An elevator operator losing rail service, and thereby experiencing increased freight rates could: (1) pass part of the increase cost forward; (2) absorb some of the cost increase; (3) pass part of the cost increase back to farmers; or (4) any combination of (1), (2), and/or (3).

ΔC_E could be represented by $\Delta C_E = C_A - C_R$, where:

$$C_A = \sum_{i=1}^n C_{Ai} Q_{Ai}; \text{ and}$$

$$C_R = \sum_{i=1}^n C_{Ri} Q_{Ri}; \text{ where,}$$

C_{Ai} = the cost per bushel of transporting grain from the i th elevator to the final destination which is absorbed by i th elevator, if branch line abandonment does take place;

Q_{Ai} = the quantity of grain shipped from the i th elevator to the final destination if branch line abandonment does take place;

C_{Ri} = the cost per bushel of transporting grain from the i th elevator to the final destination which is absorbed by the i th elevator, if branch line abandonment does not take place; and

Q_{Ri} = the quantity of grain shipped from the i th elevator to the final destination if branch line abandonment does not take place.

If $C_A > C_R$, then branch line abandonment would result in a net increase to all elevators in aggregate in the cost of moving grain from the elevator to final destination. If $C_R > C_A$, then branch line abandonment would result in a net decrease to all elevators in aggregate in the cost of moving grain from the elevator to the final destination.

If it is not feasible for an elevator operator to pass a freight rate increase foreward or backward, or absorb the increase, then the

elevator operator has several other options which would include:

1. The elevator operator could relocate his business;
2. The elevator operator could go out of business; or
3. The elevator operator could seek some type of government subsidy.

Summary

Following the method developed in this chapter, there are two cost changes which need to be aggregated in order to determine the costs associated with the alternative of trucking. The first cost change is the increase in cost or reduction in revenue to all farmers as a result of branch line abandonment. The second cost change is the increase in cost or reduction in revenue to all elevator operators as a result of branch line abandonment.

Δ LRC as defined in the introduction to this chapter could be compared to long-run profitability as developed in Chapter II to partially evaluate branch line abandonment and determine a possible subsidy. However, to complete the evaluation of branch line abandonment and determine a possible subsidy it is also necessary to consider the social benefits and costs associated with branch line abandonment. Social benefits and costs associated with branch line abandonment are discussed in Chapter IV.

CHAPTER IV

SOCIAL IMPLICATIONS OF BRANCH LINE ABANDONMENT

Introduction

The purpose of this chapter is to identify and discuss some social implications of branch line abandonment, with emphasis on the role of public policy to maintain or promote desirable social ends.

The diversity among various groups and individuals makes it somewhat difficult to explicitly define desirable social ends. For that reason, only a very general discussion of social implications is possible.¹

A homogenous type of grain was considered to be the only commodity transported for the purpose of the analysis developed in Chapters II and III. In order to remain consistent, in Chapter IV it is also assumed that the only commodity being transported by rail or truck is a homogenous type of grain. However, the arguments and considerations presented in Chapter IV could easily be applied to any number of commodities being transported.

It is difficult to determine public policy on any controversial issue, including branch line profitability and abandonment. Public policy can be thought of as the actions, decisions, and rulings made

¹The social implications of branch line abandonment could be determined using a benefit-cost type of analysis. Benefit-Cost and Policy Analysis 1974, edited by Richard Zechauser and others contains considerations and techniques used in benefit-cost analysis. An example in benefit-cost analysis is presented on pages 392 to 416.

by national, state, or local lawmaking bodies, commissions, or agencies. The vastness of laws and other rulings on branch line profitability and abandonment make it impractical to mention all those laws, rulings, and the implications. Therefore, the Regional Rail Reorganization Act of 1973, which offers a concise, easily perceptible view of one major aspect of public policy as related to branch line profitability and abandonment, is considered to be typical of public policy with respect to these issues.

The Regional Rail Reorganization Act of 1973

The purpose of the Regional Rail Reorganization Act of 1973 was to remedy the problem of Northeastern railroad failures. The Act is concerned with establishing a financially viable railroad system from the segments of seven bankrupt railroad companies. To accomplish this end Congress established two corporations to maintain essential service to customers of the bankrupt railroad companies. The United States Railway Association (USRA) is a nonprofit government corporation which has the responsibility of designing a regional railroad system plan. The Consolidated Rail Corporation (ConRail) is a for-profit common carrier established to acquire and operate essential properties of bankrupt railroads. The USRA will identify those essential rail lines of bankrupt railroads which are to remain in service. The essential rail lines may be purchased by ConRail or existing solvent railroads in the region. Lines declared to be non-essential will be abandoned unless

railroad users, communities, or states purchase the lines or subsidize operations.²

The Executive Branch proposed to establish ConRail to function for two years as a transitional mechanism. The function of ConRail would be to provide for the rehabilitation of track and orderly sale of bankrupt lines to financially solvent railroad companies. The President's proposal also provides for abandonment of non-essential lines except where states, local communities, or shippers will purchase lines or subsidize operations.³

The Act also provides that federal financial assistance will be made available to states, local communities, and regional transportation authorities. Up to seventy percent of operating losses incurred by local railroad operations may be offset on a temporary basis by federal rail service continuation subsidies. In cases where operational subsidies are not requested, federal sources may provide 70 percent loans for the purchase of local lines and 70 percent loans or loan guarantees for repair of acquired railroad lines.⁴

The Regional Rail Reorganization Act of 1973 reflects a new government attitude toward the railroad industry. The new attitude is one of response to generally declining economic conditions of many railroad companies. The series of major railroad failures has prompted

²Johnson and Mennom, op. cit., p. 15.

³Ibid., p. 16.

⁴Ibid., p. 16.

policy makers to give more attention to the public interest and to devise policies to protect and maintain the financial viability of the railroad industry.⁵

Previously, the balancing of interests approach to adversary line abandonment proceedings required both communities and the railroad to bear the burden of proof in argumentation. However, the railroad bore the financial burden. Under rules established by the Regional Rail Reorganization Act, and supported by the President, both disputing parties continue to bear the burden of proof, but financial responsibility for continuation of potentially unprofitable operations has been shifted to the railroad user. The new rules provide a market test of local willingness and ability to pay for continued railroad service, after consideration of various transport alternatives.⁶

The Regional Rail Reorganization Act of 1973 applies only to seventeen Northeastern states. However, Midwestern congressmen have introduced legislation to expand the provisions of the Act to the entire nation. A basic feature of several of the bills, written in national scope, is the shift of financial responsibility from the railroad to states, local communities, or users with rail service continuation subsidy or loan assistance.

Impacts of Branch Line Abandonment on the Highway System

Many of the social impacts of branch line abandonment are difficult to measure in monetary terms. However the impacts of branch line abandonment on the highway system are readily identified and can be

⁵Ibid., p. 16.

⁶Ibid., p. 16.

measured in monetary terms.

Grain moves from the farm to country elevator in a number of modes of transportation, including tractor and farm wagon, pickup truck and gooseneck trailer, single or multi-axled trucks, or semi-tractor-trailer units. For the purpose of this study, trucking as related to the movement of grain from farm to country elevator includes all the above modes.

Grain is moved from the farm to country elevator over township, county, state, or federal highways, depending upon the relative locations of a farmer and the elevator at which he sells his grain.

Since the alternative to shipping grain by rail is to ship grain by truck, it is reasonable to assume that it would be necessary to up-grade and maintain a highway to the necessary standards so that grain trucks can pass over the highway.

When more than one end product is derived from some basic material, the costs of processing it to a point where end products can be identified are usually allocated to the end products. The costs which are common to the resulting products are called joint costs, and the resulting products called joint products. If joint products are approximately equal with respect to relative values, they are often referred to as co-products. If each of the co-products is to share the joint costs, it is not always easy to decide how the joint costs should be allocated. Joint costs may be apportioned with respect to weight, chemical content, or other physical attributes. Sometimes

the joint costs are apportioned relative to market values of the co-products.⁷

A highway can be thought of as a basic material from which two products are derived. The two products are a transportation network for automobiles and other private vehicles and a transportation network for trucks and other commercial vehicles.

Because a highway is a joint facility that is provided for trucks and private automobiles, any cost allocation must be arbitrary. However, the following allocation seems reasonable. Since automobiles require much lower highway design standards than trucks, automobiles should be held responsible for their share of the costs of constructing a highway to meet their needs. Trucks should then be held responsible for bearing the full incremental or additional costs needed to build a highway to meet their requirements. Since trucks contribute to wear and tear of the basic roadway, they should also contribute to its cost in proportion to their use. Thus costs should be allocated among different types of vehicles on an average-marginal basis in which all vehicles proportionately share in each of the cost increments for which they can be held responsible.⁸

A study prepared for the Department of Transportation by Iowa State University contained estimates for increased construction and maintenance costs resulting from increased traffic.⁹ The basic assumption underlying the cost determinations was that construction

⁷Carl L. Moore and Robert K. Jaedicke, Managerial Accounting (4th ed.; Cincinnati, Ohio: South-Western Publishing Co., 1976), pp. 297-8.

⁸Friedlaender, op. cit., pp. 37-8.

⁹Iowa State University, op. cit., pp. 230-8.

and maintenance costs for road surfaces and structures vary directly with the number of equivalent axle loadings. It was assumed, therefore, that the increased highway construction and maintenance costs resulting from railroad abandonments were based on the cost of resurfacing a road segment after it had deteriorated from new or like new condition to the point of needing resurfacing.

The additional construction and maintenance costs per truck-mile were determined only for 36-ton trucks traveling over interstate rigid pavement. Those results were that increased construction costs would be \$0.00319 per truck-mile and increased maintenance costs would be \$0.00133 per truck-mile.

There are other methods used to apportion joint costs. The Presidential Advisory Committee on Water Resources Policy issued a report in which it was stated that those benefiting from or using a joint facility should pay for the joint facility in proportion to benefits received or use derived.¹⁰

In practice, license fees, compensation plates, and fuel taxes are used as methods of apportioning the costs of construction and maintenance of highways to the various users. Those highway construction and maintenance costs which are not covered by license fees, compensation plates, and fuel taxes must of necessity be paid by some unit of government.

¹⁰Presidential Advisory Committee on Water Resources, Water Resources Policy (Washington, D.C.: United States Government Printing Office, 1956), pp. 29-32.

It is not the intent to advocate or propose any particular method of apportioning highway costs between automobiles and trucks. The purpose of discussing apportionment of highway costs is to illustrate the necessity of apportionment and present methods used to apportion joint costs.

The total present value of highway construction and maintenance costs apportioned to an increase in grain truck traffic can be represented by:

$$H = M_0 + \frac{M_1}{1+r} + \frac{M_2}{(1+r)^2} + \dots + \frac{M_n}{(1+r)^n} \quad \text{where,}$$

H = the total present value of all costs of highway construction and maintenance apportioned to increased grain truck traffic;

M_i = highway construction and maintenance costs apportioned to increased grain truck traffic in the i th year, where

$i = 0, 1, \dots, n$;

r = the discount rate used; and

n = the number of years the highway is expected to provide useful service.

There are several cases which describe degrees of highway construction and maintenance necessary to support increased grain truck traffic. Those cases are:

Case 1. A highway which would be used by both automobiles and trucks is to be constructed where previously no highway existed;

Case 2. A highway which has been used for its original expected lifetime is to be re-constructed;

- Case 3. A highway presently in service needs to be up-graded in order to carry grain trucks;
- Case 4. A highway presently in service needs to be up-graded in order to carry both automobiles and grain trucks; and
- Case 5. Normal maintenance is required on a highway designed to carry both automobiles and trucks.

The cost of building a new highway as described in Case 1 could be represented by $C_T = C_A + C_B$, where

C_T = the cost of constructing the highway to the degree that trucks can use the highway;

C_A = the cost of constructing the highway to the degree that automobiles can use the highway; and

C_B = the cost in excess of C_A necessary to construct the highway so that trucks can use the highway.

Following the apportionment principle suggested by Friedlaender, trucks should be responsible for C_B and C_A would be apportioned between automobiles and trucks.

In Case 2 it is assumed the highway was originally intended for automobiles. Case 2 could be analyzed in the same manner as Case 1. Since the highway originally had been intended for automobiles, automobiles can be apportioned all of C_A and trucks can be apportioned C_B . However, it can be argued that since trucks receive some benefits from C_A , they should share in C_A .

In Case 3 it is assumed that the highway is sufficiently constructed in order to carry automobiles, but not trucks. If such is the

case, the entire cost of upgrading the highway to the point where it will support truck traffic would be apportioned to trucks.

In Case 4 the procedure and logic for assigning maintenance costs would be the same as the assignment of construction costs in Case 1.

In Case 5 automobiles would be apportioned the cost necessary to maintain the highway to meet their requirements and trucks would be apportioned the additional cost necessary to maintain the highway to meet truck requirements. Again it can be argued that since trucks receive some benefits from the highway being maintained to car standards, trucks should be apportioned part of that cost.

Some highway maintenance is necessitated by factors other than traffic. For example, freezing and thawing, temperature extremes, and moisture are factors other than traffic which necessitate highway maintenance. It would be necessary to apportion those maintenance costs to both automobiles and trucks.

It is important to note that while rail abandonment may lead to additional highway construction and maintenance costs, rail abandonment does represent a savings to the railroad of the amount necessary to up-grade and maintain the abandoned branch line.

When assessing the effects of rail abandonment on the highway system, it is important to consider only the marginal effects on the transportation network. Whether rail abandonment does or does not take place, grain will be carried by truck, and therefore wear and damage will be done to roads over which grain trucks travel. If rail

abandonment causes more grain trucks to do more wear on and damage to roads, the effect of rail abandonment should be considered only as the increase in wear and damage and costs associated therewith.

Essentially the effect on or damage done to roads and highways is dependent upon three considerations: (1) the absolute increase in traffic; (2) the increase in traffic as a percent of total traffic; and (3) the condition and construction of the roads and highways which bear increased traffic as a result of rail abandonment.

External Benefits and Costs of Rail Service

External benefits and costs, also called externalities, are important considerations when comparing truck and rail transportation.

When a cost or benefit is incurred by somebody other than the producer or buyer, we say that it occurs outside of the market transaction, and thus is an externality.¹¹

It is not practical to attempt to list, describe, or otherwise note all the ways in which individuals, groups, or communities receive external benefits from branch line service.

A community, in aggregate, may experience external benefits from branch line service. If the main link between a community and outside markets is a branch line, then it is possible that the community would become economically depressed and may cease to function as a community if branch line service were discontinued. If such is the case, the community most certainly experiences external benefits

¹¹William P. Albrecht, Jr., Economics (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1974), p. 46.

from branch line service. It is important to note that there are many factors which contribute to the decline and death of any rural community. Loss of branch line service is only one of many factors. In some cases rural communities would eventually decline and cease to exist whether or not branch line service was provided.

There may be external costs associated with branch line service. For example, noise pollution, air pollution, traffic congestion, and dangerous rail crossing are all possible external costs of branch line service.

External Benefits and Costs of Truck Transportation

External benefits of truck transportation are similar to the external benefits of branch line service. In some cases, truck transportation may provide the same essential service to a particular community that branch line service does to another community.

The external costs of truck transportation are also similar to the external costs of branch line service. Typical external costs of truck transportation are noise pollution, air pollution, traffic congestion, and damage to roads and highways.

Pecuniary Effects of Rail Service and Truck Transportation

Pecuniary effects of branch line service are the effects on prices of resources caused by the actions of a railroad company. Pecuniary effects are slightly different than external effects.

There are other external consequences, however, which do not affect the units of output (or pleasure) that can be obtained from a firm's (or a consumer's) physical inputs. These will be called "pecuniary spillovers," for they are occasioned by shifts in prices.¹²

There are numerous examples of pecuniary effects of branch line service. For example, the purchase of resources by a railroad company may cause the price of those resources or related resources to increase.

The pecuniary effects of truck transportation are the effects on prices of resources caused by the action of a trucking firm.

Summary of External and Pecuniary Effects

External costs and benefits and pecuniary effects are similar in nature for both rail and truck transportation. It is difficult to compare external benefits and costs because they are not readily measured in monetary terms. It is also difficult to measure pecuniary effects because it is not likely that there is sufficient knowledge of the supply and demand functions for all resources used in rail and truck transportation.

Other Social Considerations

If grain is not carried by rail, then the grain must be carried by truck. Rail abandonment would lead to the increased use of commercial trucks to transport grain. If the commercial trucks are operated by local entrepreneurs it is likely that income earned by transporting grain will increase in South Dakota.

¹²Roland N. McKean, Efficiency in Government Through Systems Analysis (New York: John Wiley and Sons, Inc., 1958), pp. 136-7.

It is difficult to compare rail and truck freight rates. One reason for this is that many truckers are independent and not subject to rate regulations. Independent truckers may charge different rates at different times. If on the average, rail rates are less than truck rates and rail abandonment takes place, the increased use of trucks to transport grain may (or may not) bring about economies of scale in the trucking industry resulting in average truck rates that are less than rail rates previously had been.

Private and Public Concerns in Transportation

When rail or truck transportation is provided by a private enterprise it is usually done to meet a demand for that service. In most cases it is in both the public interest and private interest that a particular service be provided. For example, if a railroad company profitably provides transportation to a community both the railroad and the community benefit from that service. The railroad company earns profits by providing rail service while the community is provided with essential transportation. In such a situation public and private interest are compatible.

When a railroad company wishes to abandon a section of branch line public and private interests are not always compatible. For example, if a railroad company is operating a branch line at a financial loss it is in the best interest of the railroad company to abandon the branch line. However, if service on that branch line seems vital to some individual, group, or community, then abandonment may not be in the public interest.

Reconciling Public and Private Interests by Subsidy

When public and private interests are in conflict, as in some branch line abandonment cases, there are three ways in which the proper officials may deal with the conflict. They are: (1) the railroad company could abandon the branch line, thereby maintaining the private interest at the expense of the public interest; (2) the railroad company could be forced to continue operation of the branch line, thereby maintaining the public interest at the expense of the private interest; or (3) some unit of government could subsidize the branch line operation or users of branch line service as developed in Chapter II, page 46.

The level of subsidy would be determined by the willingness of the affected community to pay for retention of branch line service. Each affected community would base its willingness to pay for retention of branch line service on long-run factors particular to that community. Factors taken into consideration by the community would include:

1. The long-run cost of using trucking as an alternative to rail service as developed in Chapter III;
2. The long-run impacts of branch line abandonment on the highway system;
3. The long-run external and pecuniary effects of branch line service; and
4. The long-run external and pecuniary effects of truck transportation.

Once the community has determined its willingness to pay for retention of branch line service, that willingness would be compared

to the financial loss incurred by the railroad company. If the community is not willing to at least cover the financial loss, then the railroad would be allowed to abandon the branch line. If the community is willing to cover the financial loss, then the railroad company could receive a subsidy to at least cover the operating loss. The subsidy could come from local, state, or federal government, marketing or consumer cooperative, or any other affected group.

Summary

The long-run net social costs or rail abandonment would be determined by factors such as: (1) impacts on the highway system resulting from branch line abandonment; (2) external benefits and costs of rail service; (3) external benefits and costs of truck transport action; (4) pecuniary effects of rail service; and (5) pecuniary effects of truck transportation.

Although it is difficult to measure and quantify the social benefits and costs of branch line abandonment, those benefits and costs are presented so that they can be at least considered in analyzing and evaluating branch line abandonment.

When public and private interest are coincident it is not necessary to make public policy to maintain public goals. When, as in rail abandonment, there is a difference between public and private interest it is necessary to make public policy to reconcile the difference.

Pursuant to the Regional Rail Reorganization Act of 1973, communities are required to determine their willingness to pay for retention of rail service. Once communities have determined their

to the financial loss incurred by the railroad company. If the community is not willing to at least cover the financial loss, then the railroad would be allowed to abandon the branch line. If the community is willing to cover the financial loss, then the railroad company could receive a subsidy to at least cover the operating loss. The subsidy could come from local, state, or federal government, marketing or consumer cooperative, or any other affected group.

Summary

The long-run net social costs of rail abandonment would be determined by factors such as: (1) impacts on the highway system resulting from branch line abandonment; (2) external benefits and costs of rail service; (3) external benefits and costs of truck transport action; (4) pecuniary effects of rail service; and (5) pecuniary effects of truck transportation.

Although it is difficult to measure and quantify the social benefits and costs of branch line abandonment, those benefits and costs are presented so that they can be at least considered in analyzing and evaluating branch line abandonment.

When public and private interest are coincident it is not necessary to make public policy to maintain public goals. When, as in rail abandonment, there is a difference between public and private interest it is necessary to make public policy to reconcile the difference.

Pursuant to the Regional Rail Reorganization Act of 1973, communities are required to determine their willingness to pay for retention of rail service. Once communities have determined their

willingness to retain rail service an amount of subsidy is determined.

If the subsidy is not sufficient to cover financial losses incurred in the provision of branch line service, the line is qualified for abandonment. If the subsidy is sufficient to cover financial losses, subsidized branch line service is continued.

CHAPTER V

SUMMARY, SUGGESTIONS FOR FURTHER RESEARCH, CONCLUDING OBSERVATIONS

Summary

Many studies have been undertaken to evaluate specific aspects of railroad branch line abandonment. However, at this writing an approach for analysis and evaluation of branch line abandonment based on revenues and costs attributable to branch line operation and social implications of branch line abandonment has not been presented. The purpose of this paper was to develop an approach which could be used for analysis and evaluation of potential branch line abandonments in accordance with appropriate economic theory.

The approach for analysis and evaluation of potential branch line abandonments was developed through the pursuit of three objectives. The first objective was to develop an approach to allow determination of the profitability of branch line operation based upon costs and revenues associated with branch line operation. The second objective was to develop an approach for evaluation of the use of truck transportation as an alternative to rail service. The third objective was to identify and discuss the social implications of branch line abandonment, with emphasis on the role of public policy to maintain or promote desirable social ends.

Evaluation of the financial viability of branch line operation was based upon two considerations. One consideration was revenues attributable to branch line operation. The second consideration was costs attributable to branch line operation.

The cost of adjusting to alternate modes of traffic was developed using a marginal type of analysis. Two types of cost increase were considered. They were: (1) the additional cost to a grain producer of trucking his grain to a country elevator; and (2) the increased cost of moving grain from a country elevator to the final destination by truck.

The provisions of the Regional Rail Reorganization Act of 1973 were considered typical of public policy with respect to branch line abandonment. One major feature of the Act is that communities about to lose branch line service are required to determine their willingness to pay for retention of branch line service if they wish to protest the proposed abandonment.

Based on the approach developed in Chapters II, III, and IV, there are seven steps in evaluating a branch line abandonment. They are:

1. To determine the long-run revenue attributable to branch line operation;
2. To determine the long-run costs attributable to branch line operation;
3. To subtract (1) from (2) to determine the net long-run loss attributable to branch line operation;
4. To determine the long-run cost of using trucking as an alternative to rail service, Δ LRC as defined in Chapter III;
5. To determine the long-run net social cost of branch line abandonment as developed in Chapter IV;
6. To aggregate (4) and (5) to determine the long-run costs of branch line abandonment; and

7. To compare (3) to (6).

If $(3) > (6)$, the net loss resulting from operation of a branch line is greater than the cost of the alternative of trucking and the net social costs of abandonment. Therefore it logically follows that the branch line would be abandoned.

If $(6) > (3)$, the cost of the alternative of trucking and the net social costs of abandonment are greater than the net loss resulting from operation of a branch line. If $(6) > (3)$, the branch line may continue operation if operation of the line is subsidized. The subsidy could come from any source and could be paid either to the railroad company or users of branch line service.

Figure 9, page 45 illustrates a situation where branch line operation is unprofitable in the long-run. A subsidy to the railroad company would lower the $LRAC_C$ while a subsidy to users of branch line service would raise the AR_C and MR_C curves. In order to provide a sufficient subsidy, the effect of the subsidy must be to shift the $LRAC_C$ and AR_C curves such that for some level of output $AR_C > LRAC_C$.

Suggestions for Further Research

This study offers an approach by which potential branch line abandonments can be analyzed and evaluated. The approach developed in this study is the first step in the process of analyzing and evaluating branch line abandonment. Specific suggestions for future study are:

1. To expand the approach developed in this paper by considering products other than grain being exported. A more comprehensive approach would consider a major portion of all

products being imported or exported;

2. To develop and analyze a demand function for rail freight service on both branch and main line railroads, with emphasis on the cross elasticity of demand of rail and truck freight services;
3. To develop a conceptual model which would indicate the optimum mix of truck and rail traffic. Such a model would provide for variable rail rates, truck rates, and distance of haul;
4. To empirically estimate the costs associated with the adjustment to alternate modes of traffic;
5. To analyze the effect of various types of subsidy on cost and revenue functions; and
6. To include abandonment costs¹ and salvage value in determination of branch line profitability. Abandonment costs and salvage value were not considered because they are costs and revenues associated with branch line operation which occur only after abandonment has taken place.

Concluding Observations

The approach developed in this paper calls for empirical data in order to determine revenues attributable to branch line operation, costs attributable to branch line operation, and costs of shifting to

¹Abandonment costs as used in this context refers to the cost to the railroad company of removing its property from an abandoned branch line.

alternate modes of transportation. In order to apply the approach, it is necessary to use reliable empirical data.

The approach developed in this paper is useful because it offers a format by which the business objectives of the railroad industry and social objectives of the community can be compared. By comparison of the two objectives, either subsidy or abandonment would result. This approach is the essential first step in an economic analysis of railroad branch line abandonment.

This approach can be used by communities, states, the Federal government, and the railroad industry. However, the intent of this paper was to provide public officials, legislators, and regulatory agencies with an economic tool by which branch line abandonment can be analyzed from an objective point of view.

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